March

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Science and Invention

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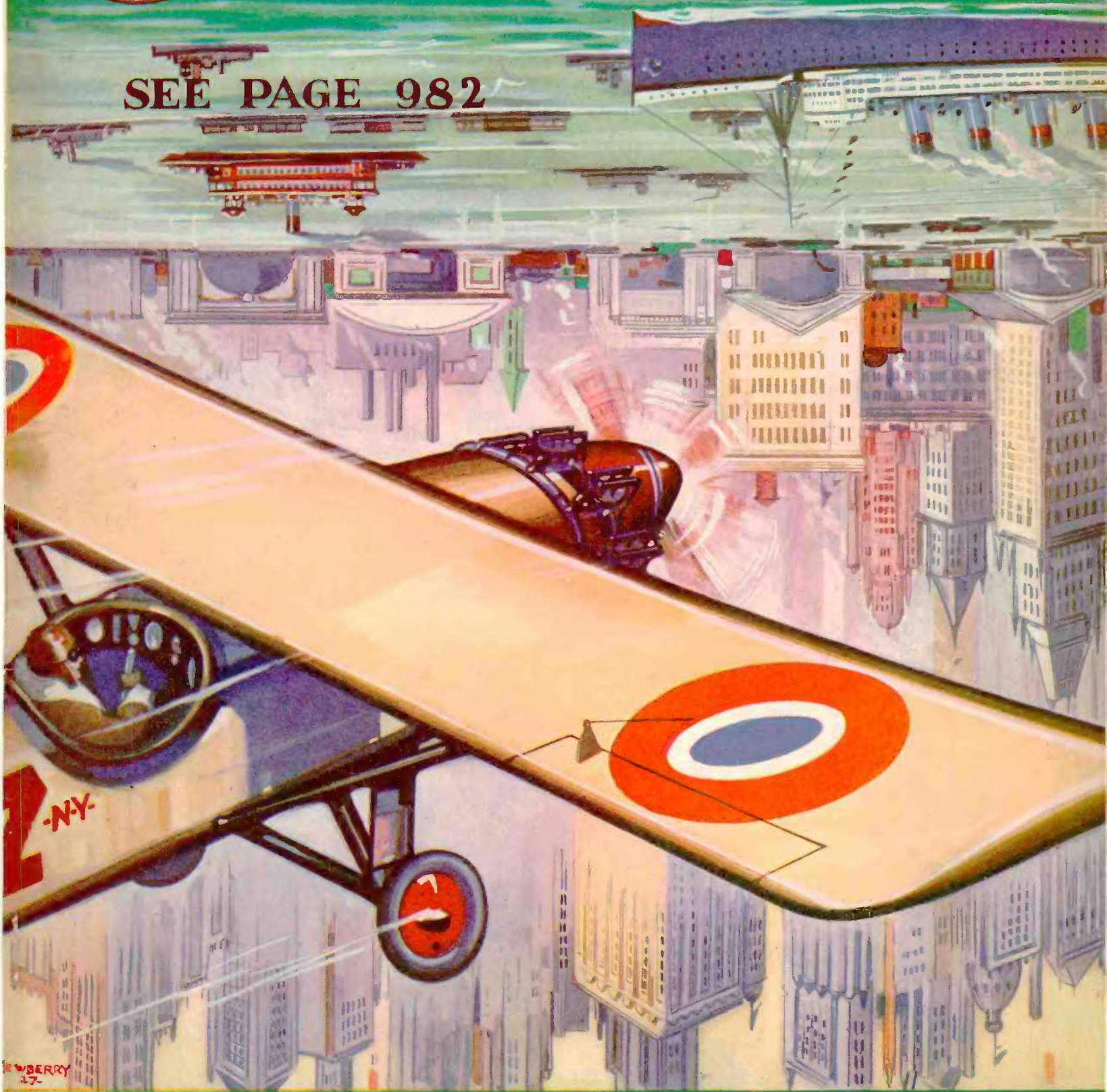

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS - RADIO LISTENERS' GUIDE - - FRENCH HUMOR - AMAZING STORIES

EVEREADY COLUMBIA Dry Batteries

–they last longer

You needn't experiment with batteries

THE field for building things and experimenting with new ideas is so big it's a waste of time to try out different kinds of dry batteries. If there is anything in the electrical field that's fixed, it's the six-inch dry cell with the Eveready Columbia label.

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NATIONAL CARBON CO., Inc.
New York UCC San Francisco
Unit of Union Carbide and Carbon Corporation

FOR RADIO: Insist on the No. 7111 dry cell, six inches of battery goodness, scientifically designed to give its best results on radio sets using tubes of the WD-11 and WX-11, and UV-199 and UX-199 types.

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PREPARING you to fill a fine Drafting job at a substantial raise in pay . . .
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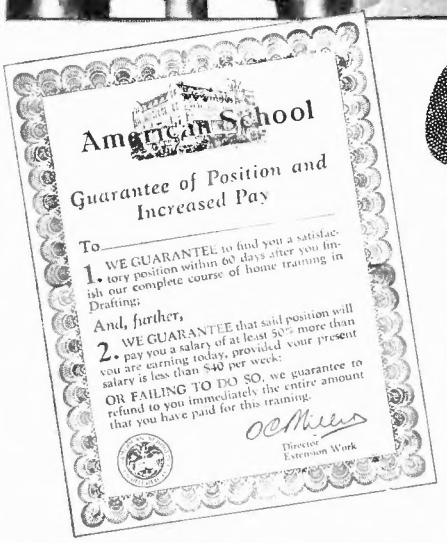
FINDING you the better-paid position and PLACING you in it, or money refunded . . . .


American School
Guarantee of Position and Increased Pay
To
1. WE GUARANTEE to find you a satisfactory position within 60 days after you finish our complete course of home training in Drafting;
And, further,
2. WE GUARANTEE that said position will pay you a salary of at least 50% more than you are earning today, provided your present salary is less than $40 per week;
OR FAILING TO DO SO, we guarantee to refund to you immediately the entire amount that you have paid for this training.
Director Extension Work

Come into Drafting!

Men who can read blue-prints and draw plans are "sitting pretty" these days. No wonder, when you consider that every machine, every building, all industrial activities *start* on the Drafting table! Intensive production, record-breaking construction operations, have created a great demand for expert Draftsmen capable of designing and calculating original plans.

$50 to $125 a week paid to Expert Draftsmen

Get this point—that Drafting isn't just *one* line of work—it reaches out into the Electrical, Manufacturing, Building Construction, Automotive and Structural industries. That is why you'll find well-paid Drafting positions advertised in all industrial centers of the U. S. 70,000 vacancies reported in the past 12 months. And that is why I advise men to go into Drafting, particularly if handicapped by lack of high-school or college education. Today you are in competition with high-school and college graduates for the better-paid jobs. You must have *specialized training* to win.

The Entering Wedge to Success in all Building and Manufacturing Lines

I recommend Drafting, too, because it can be QUICKLY learned at home, in spare time—without quitting your job, without losing a day's time or a dollar in pay. Because you're sure there will be a good position waiting when you are ready for it. And because the work is so fascinating and offers better-than-ordinary chances for advancement. For the Draftsman is in close contact with important work and BIG MEN, and he is right in line for promotion to Superintendent and other executive positions.

A Drafting Job GUARANTEED

paying 50% more than you earn today —or not a penny of cost!

Now, at a cost you can afford, on terms of only $6 per month, you can actually BUY a fine Drafting position and a substantial increase in pay. A million-dollar institution guarantees both—the training, then the employment. *Under money-back penalty.*

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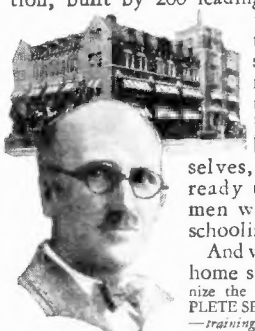
Chartered 30 years as an EDUCATIONAL institution and like the best resident schools and colleges, conducted NOT FOR PROFIT. We offer complete, thorough up-to-date instruction, built by 200 leading Educators, Engineers and Executives. A unique instruction, built to meet the specifications of well-paid jobs as laid down by employers themselves, yet simplified for ready understanding by men with only common schooling.



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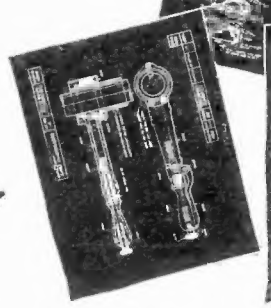
Director Extension Work

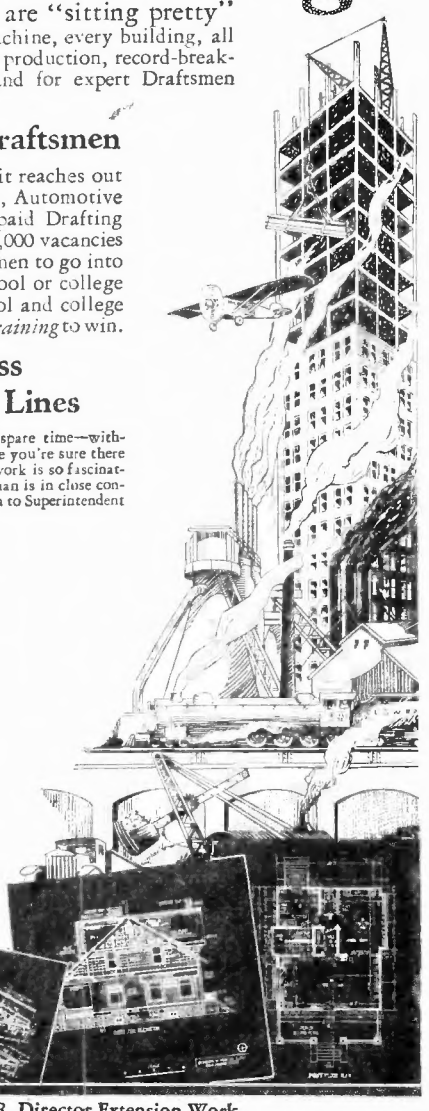
And we are the first in the home study field to recognize the need of giving a COMPLETE SERVICE to ambitious men—*training, plus employment.* Which takes you as you are, supplies the equipment you lack, and lands you in the better job you seek. Without risk to you!

3 Drafting Lessons *Actually* FREE!

to prove you can learn at home, in your spare time!

You will never have a more serious personal problem than deciding your future life-work—so we merely urge you to LOOK INTO Drafting. See how you like it, see if you learn as readily as most men do, get the facts about the opportunities, the salaries paid, the jobs open, the chances for promotion. This is why, on receipt of your name, we will send you *the first three lessons of our Drafting course* without cost or obligation.





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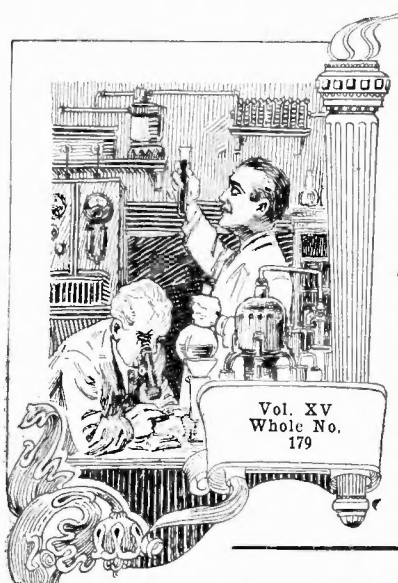

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One of the greatest questions of all time is—why can't a man grow a new limb, if he should lose one in an accident? How animals respond under such conditions will be explained by an expert.

Sea Serpents?

Do you believe the stories told for generations regarding immense sea serpents? The latest scientific explanation will appear in the next issue.

Moving the Tower of Pisa

The greatest engineering feat imaginable — necessitated by water undermining foundation of leaning structure.

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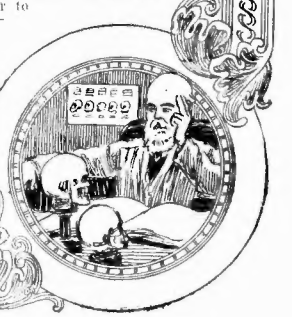
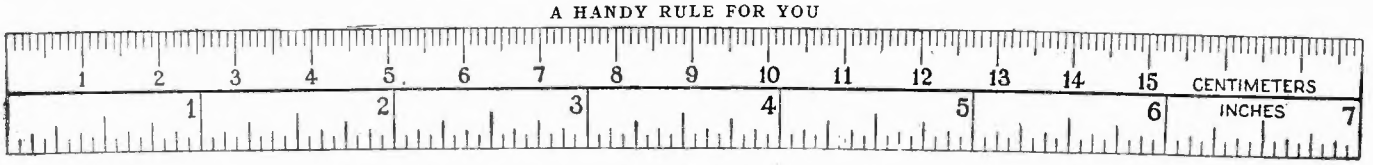


A HANDY RULE FOR YOU



If You are Making a Penny Less Than $50 a Week, Send for This FREE BOOK

GET a copy of this 64-page book. Hundreds of other fellows have found the way to Success through this book. Mail the coupon for a copy today. See what Radio offers you. Don't envy the man who is pulling down big money. You can learn to be a Radio expert at home in spare time. Why go along at $25, $30, or $45 a week when the good jobs in Radio pay $50 to $250 a week?

HERE'S BIG PAY WORK THAT'S ALMOST ROMANCE

Today's big-pay field is Radio. Its rapid growth from a two-million dollar industry to over five hundred million dollars in a few years has amazed the world. Many fortunes have been made by this rapid growth—many more will be made in the future. Trained men are needed to carry on the tremendous Radio business that has been created. The work is easy fascinating, interesting. Salaries range from $50 to $250 a week in the best jobs. Here is a most remarkable opportunity for quick financial independence. "Rich Rewards in Radio" gives you facts and proof.

LEARN AT HOME TO BE A RADIO EXPERT

My practical method makes learning easy and interesting. With six big outfits of Radio parts, given without extra charge, you build and experiment with practically every type of receiving set known today—also learn how to locate and remedy common set troubles. In a short time you can be ready for a new job—you'll know the "how" and "why"—you'll have confidence in yourself because you will have worked out just the kind of problems that come up—not with toys, but real Radio parts and sets. This kind of training gives you experience while learning. It shows up too in your pay envelope.

PAY YOUR TUITION OUT OF SPARE TIME EARNINGS

Almost the day you enroll I begin showing you how to make money on the side. Many students earn $15, $20, and even $30 a week in spare time. I'll show you how to get jobs, what to charge, tell you what methods made money for other students—give you tested ideas, hints, tips, pointers. Earle Cummings, 18 Webster Street, Haverhill, Mass., made $375 in one month; George Page, 1807 21st Ave. S., Nashville, Tenn., picked up $935 in his spare time while studying.

YOU MUST BE SATISFIED

I'll give you a written agreement the day you enroll to refund your money if after completion you are not satisfied with the course I give you. You are the only judge. The resources of the N. R. I.—the Oldest and Largest Home Study Radio Training Organization in the world, stands back of this agreement.

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I want to help you become successful. My 64-page book, "Rich Rewards in Radio," gives full information on the Radio industry, what it offers you, what salaries are paid, what other men are making, and how my Employment Department helps you get into Radio after you graduate. Send for a copy I won't charge you a cent. Simply clip or tear out the coupon and mail it. You don't obligate yourself in any way by mailing the coupon.

J. E. SMITH, President
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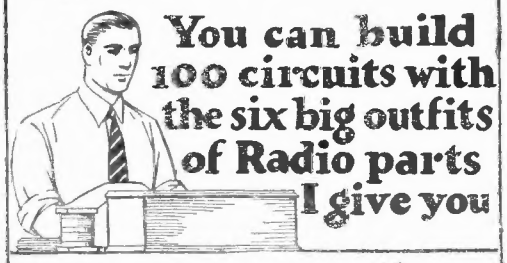
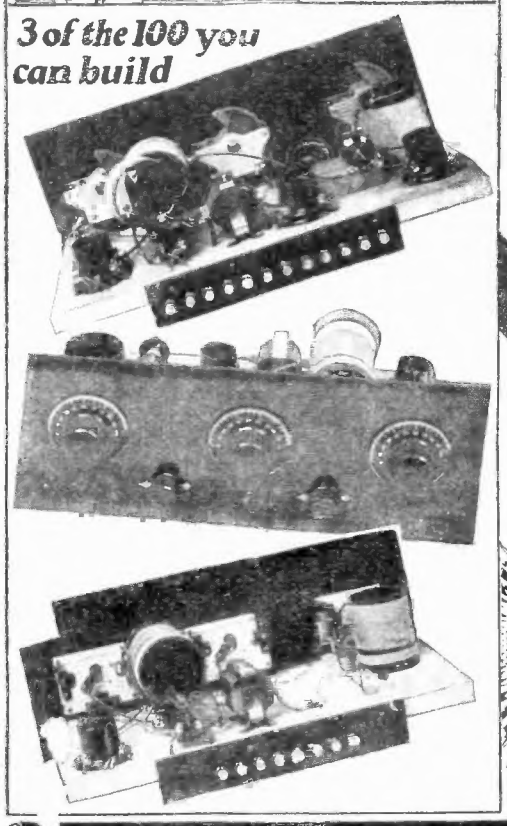


You can build 100 circuits with the six big outfits of Radio parts I give you



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RADIO NEEDS TRAINED MEN!

Read What N.R.I. Training Has done for These Men

HIGH AS $78 A WEEK

"I have made as high as $78 in one week in a retail Radio store. I estimate my total income, as the result of my knowledge of Radio, around $3,000. I know I could not have picked a better course." Frank Reese, 304 Walnut Street, Coatesville, Penna.

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"In the last ten months I have earned enough money to pay for my course twenty times. To date I haven't had a complaint on any of my work.

"A short time ago I was in Plattsburg and called on Mr. Stauffer, who is an Institute man. He is doing fine and making lots of money. I want you to use this letter and my picture in any way that it will help you."—William E. Riddle, 9 Stevenson Lane, Saranac Lake, N. Y.

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Name..... *Age*.....

Address.....

City..... *State*.....

Employment Service to all Graduates

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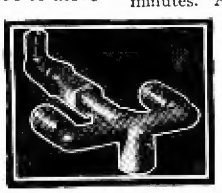
"Every 3,000 Miles This Amazing Little Device Buys Me a New Tire... FREE!"

"THE money I save on gasoline more than keeps me in new tires. Figure it out . . . I was getting 13 miles per gallon on my Nash. With gas at 18c plus 2c tax it cost me $46 to drive 3,000 miles. Now I'm getting better than 26 miles per gallon. It takes just half the gas and I save $23 to $25 every 3,000 miles—more than the price of a new tire."

No matter what make of car you drive, the Stransky Vaporizer is unconditionally guaranteed to give you 50% to 100% more miles per gallon or it costs you nothing. As a matter of fact, it is not uncommon for the Stransky Vaporizer to more than double gasoline mileage!



FITS ANY CAR IN 5 MINUTES

Anyone can install this device in 5 minutes. Simply loosen one connection to the intake manifold with a wrench. You can do the rest with your fingers!

Easily Installed

No bigger than a dollar coin—no more expensive than a good wrench—no more trouble to attach than a fan belt! Attaches to the intake manifold of any car in five minutes. Anyone can do it.

Less Gasoline—More Power

The vaporizer supercharges your gasoline after it leaves the carburetor. Completely vaporizes the gasoline. Under this ideal condition you get more compression out of less gasoline and a more complete explosion. Both power, pickup and speed are noticeably increased. Starting is not interfered with as the Vaporizer automatically shuts itself off when the motor is idle.

Make This Test

Test the Stransky Vaporizer on your car—and expect results that will amaze you! Double your mileage—get flashing pickup and power—forget carbon troubles, sluggish motor and fouled spark plugs from over-rich mixture—and save enough on your gasoline to more than keep you in tires. These results are guaranteed or the test costs you nothing.

Mail the coupon below for full details, guarantee, and amazing trial offer, which is even more remarkable than we can tell you here. There is no obligation whatever

43.8 Miles Per Gallon

Mr. M. E. Miller, Kansas City, writes: "You people claim a saving of 25 to 50% of Gasoline. I have subjected the Vaporizer to a severe and thorough test. After installing one on a Chevrolet, I found I was obtaining 43.8 miles to a gallon, whereas formerly I had been getting only 19.5. This is not a saving of 25 or 50%, but 124%, so you see that the actual test surpasses your claim."

Note These Records

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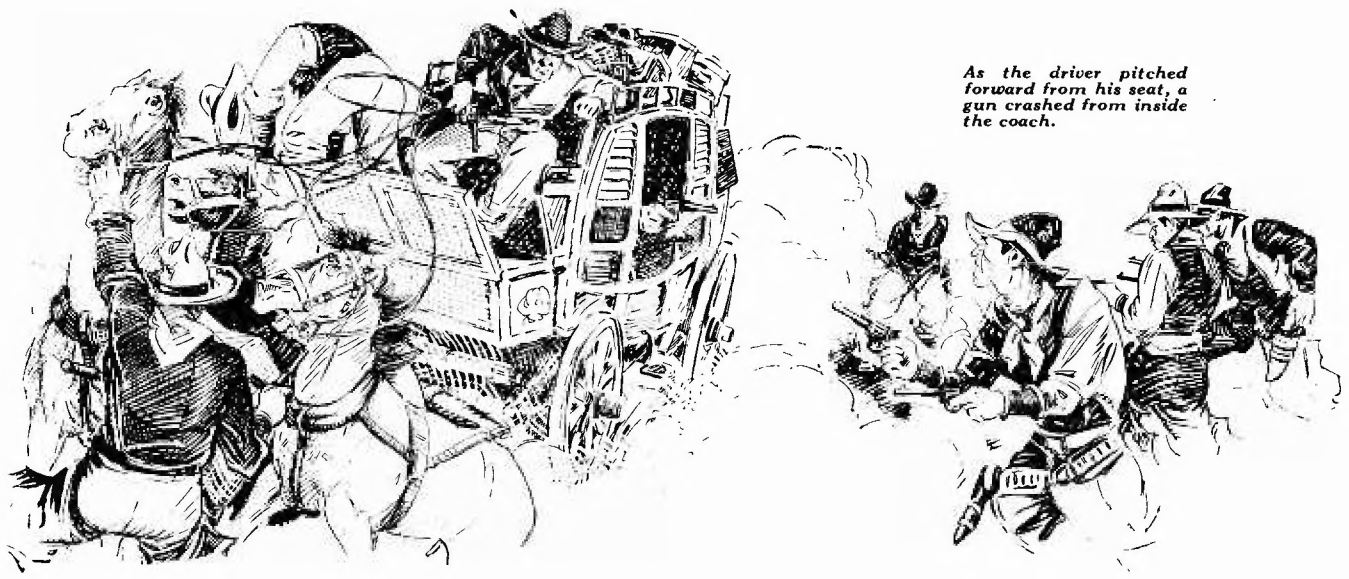

As the driver pitched forward from his seat, a gun crashed from inside the coach.

THE DEVIL'S DOUBLE-CROSS

(*A Gripping Story of the Rio Grande by Frederick Nebel*)

WHEN Sheriff Sid Gade forgot his oath of office long enough to listen to the voice of the tempter and agreed to rob a stage coach carrying a fortune in gems, he stepped into more treachery, intrigue and killings than had ever been known along the Rio Grande. It took the roaring guns of two Senora cow-pokes to make the sheriff see the light—but he did, and vindicated himself in one of the greatest gun-fights you've ever read.

THE DEVIL'S DOUBLE-CROSS

appears in the MARCH issue of

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—Morlais Couzens.

"I also have some news for you. I have been made assistant chemist for the concern I am working for."
—A. G. Delwarte.

"I am now cleaner and dyer for the above named company. My salary is almost double what it was when I started the ourse."
—E. H. Lasater.

"Your training has opened things to me that otherwise I would probably be years in acquiring. I now enjoy comforts that before I had to do without. It enabled me to have a wonderful little home, a fine laboratory of my own, and gave me a respected position in one of the foremost textile concerns in the country."
—J. J. Kelly.

"If it weren't for your course I wouldn't have the job I've got now."
—George Daynes.

"Since beginning your course of study I have received an increase in my pay check, and as I progress my work becomes lighter through a better understanding."
—M. G. Cole.

"I am mighty glad I took this course. My salary has been increased several times, and different industrial plants are coming to me for a little advice on different things, netting me a fair side income."
—M. E. Van Sickle.

IF you are dissatisfied with your present work, if you wish to earn more money, if you want to get into a profession where the demand for trained men is increasing as the Chemist plays a more and more important role in the industrial life of this country, let us teach you Chemistry.

You, Too, Can Learn AT HOME

To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position and let us educate you in Chemistry during your spare time Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory. Dr. Sloane gives every one of his students the same careful, personal supervision that made him celebrated throughout his long career as a college professor. Your instruction from the very beginning is made interesting and practical, and we supply you with apparatus and chemicals for performing the fascinating analyses and experimental work that plays such a large part in our method of teaching, and you are awarded the Institute's official diploma after you have satisfactorily completed the course.

FORTUNES HAVE BEEN MADE THROUGH CHEMISTRY

Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $10,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum, made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

NOW IS THE TIME TO STUDY CHEMISTRY

Never before has the world seen such splendid opportunities for chemists as exist today. In factories, mills, laboratories, electrical shops, industrial plants of all kinds, chemistry plays a vital part in the continuation and expansion of the business. In every branch of human endeavor the need for chemists has arisen. Those who have the foresight and ambition to learn chemistry now will have the added advantages and greater opportunities afforded while the chemical field is growing and expanding.

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3-28

JOIN THE RADIO ASSOCIATION

EARN $75.00 a week in Your Spare Time

JOINING the Radio Association enables you to cash in on Radio *now!* Follow its success-proven plans, and you can earn $3 an hour, in your spare time. from the very first. Over $600,000,000 is being spent yearly for sets, supplies, service. You can get your share of this business and, at the same time, fit yourself for the big-pay opportunities in Radio.

Founded on a New Idea

Members of the Association do not wait for months before they make money out of Radio. Without quitting their jobs, our members are earning $25 to $75 a week spare time by building "tailored" radio sets, serving as "radio doctors," selling ready built sets and accessories, or following one of the many profit-making plans of the Association.

Earned $500 in Spare Hours

Hundreds earn $3 an hour as "radio doctors." Lyle Follick, Lansing, Mich., has already made $500 in spare time. Werner Eichler, Rochester, N. Y., is earning $50 a week for spare time. F. J. Buckley, Sedalia, Mo., is earning as much in spare time as he receives from his employer.

We will start you in business. Our cooperative plan gives the ambitious man his opportunity to establish himself. Many have followed this plan and established radio stores. Membership in the Association has increased the salaries of many. Scores are now connected with big radio organizations. Others have prosperous stores.

A year ago Claude De Grave knew nothing about Radio. Today he is on the staff of a famous radio manufacturer and an associate member of the Institute of Radio Engineers. He attributes his success to joining the Association. His income now is 350% more than when he joined.

What a Membership can Do for You

1—Enable you to earn $3 an hour upwards in your spare time.

2—Train you to install, repair and build all kinds of sets.

3—Start you in business without capital, or finance an invention.

4—Train you for the $3,000 to $10,000 big-pay radio positions.

5—Help secure a better radio position at bigger pay for you.

6—Give you the backing of the Radio Association.

A MEMBERSHIP NEED NOT COST YOU A SINGLE CENT

Doubled Income in Six Months

"I attribute my success entirely to the Radio Association," writes W. E. Thon, Chicago, who was clerk in a hardware store before joining. We helped him secure the managership of a large store at a 220% increased salary.

"In 1922 I was a clerk," writes K. O. Benzing, McGregor, Ia., "when I enrolled. Since then I have built hundreds of sets—from 1-tube Regenerative to Superheterodynes. I am now operating my own store and my income is 200% greater than when I joined the Association. My entire success is due to the splendid help it gave."

Easiest Way Into Radio

If ambitious to become a Radio Engineer, to fit yourself for the $3,000 to $10,000 opportunities in Radio, join the Association. It gives you a comprehensive, practical and theoretical training and the benefit of our Employment Service. You earn while you learn. You have the privilege of buying radio supplies at wholesale. You have the Association behind you in carrying out your ambitions.

ACT NOW—if you wish Special Membership Plan

To a limited number of ambitious men, we will give Special Memberships that may not—need not—cost you a cent. To secure one, write today. We will send you details and also our book, "Your Opportunity in the Radio Industry." It will open your eyes to the money-making possibilities of Radio. Write today.

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Please send me, by return mail, full details of your Special Membership Plan, and also copy of your book, "Your Opportunity in the Radio Industry."

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Volume XV
Whole No. 179

Science and Invention

MARCH, 1928
No. 11

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, PH.D., *Associate Editor*
Editorial and General Offices - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - HUXLEY

THE GARRET INVENTOR

By HUGO GERNSBACK

RECENTLY the statement appeared, rather ill-advisedly, that the day of the "garret inventor" was gone. It was pointed out, in all sincerity, that no great inventions could possibly come from the small inventor in the future, because invention today, so the story ran, is organized in the big industrial laboratories, where everything worthwhile is now invented.

The story sounded plausible enough, because in all of the laboratories of our large industrial companies, research scientists are busy, day and night, in inventing and perfecting new devices. It is also quite true that in such laboratories the research scientists and inventors have every necessary tool, all apparatus, and, what is far more important, practically unlimited funds, all of which are used in the furtherance of science and invention. So it would seem, offhand, that such being the case the small inventor is doomed.

Actually it does not work out that way in practice, for very simple reasons. In the first place, the paid inventor in the laboratory, as well as his brother, the scientific investigator, usually works along certain lines, on certain specific problems. They are usually working for a company whose interests lie only in a narrow and restricted field. Such laboratories seldom, if ever, allow their workers to turn loose in any direction that their fancy dictates. Ninety-nine times out of one hundred, the research and invention staff will have its hands full with problems bearing directly on the business of the company, one way or another. It is quite true that in this way many new and useful inventions are developed, but most of these pertain directly to the product or products of the particular corporation. Once in a while a by-product invention comes along, which by-product may become the big thing later on, because, in the very nature of things, a new invention sometimes gives rise to dozens of others which spread out, fan-wise, from the original invention. But this does not happen every day, nor is it the usual run of things.

It is comparatively rare that a research scientist of a large corporation will tell his superiors that he wants to develop a certain idea on a new invention, which may be entirely foreign to the corporation's business. It would mean, immediately, that the man who had the idea would have to be kept on the pay roll, working on such an invention, while the corporation would have to expend funds in a direction in which it was not necessarily interested. If the head, or manager, of the corporation is sufficiently interested in such a procedure, it may come about that the inventor will finally work out his idea, but such a case is not often heard of, and is decidedly the exception.

But the inventor in the garret has no such limitations. Like as not, he invents for the pure fun of it in his spare time, and if he is a real dyed-in-the-wool inventor, he is not at all interested in whether there is any immediate monetary reward in the invention. He has no boss to dictate to him, and he is responsible only to himself as to the results. If the invention proves to be a disappointment, it is no one's business except the inventor's; while if it is a success, he may or may not reap the full reward of his labors. Dozens of examples can, of course, be given to any doubter that the garret inventor is still with us, and undoubtedly will always be with us. There is no reason for supposing that he will be exterminated by the professional corporation inventor. Quite the contrary.

Take, for instance, one of the recent great inventions upon which men are just now working feverishly; namely, *television*. There was Baird, of London, who, single-handed and with very little money, actually did invent television before it was demonstrated in this country by the engineers of the American Telephone and Telegraph Company. Likewise, even before television, C. Francis Jenkins, of Washington, had also achieved certain results in its direction. And neither Baird nor Jenkins were employed by any corporation; but they were, and still retain the status of private individuals. Then, of course, there was Armstrong, who was credited with the invention of *regeneration*, a most important radio development. Recently a large syndicate paid a million dollars for the invention of the *Photomaton*, which takes photographs of you automatically while you wait. Here, again, is the garret inventor, plodding along in the unbeaten path.

Very recently, Dr. Theremin, a young Russian physicist, discovered his new process of creating music simply by the waving of his hands. No huge and expensive laboratory was behind him to perfect this idea. It was all done in his own spare time.

But of course these are all exceptions, being mostly inventions of a spectacular nature. What about the small garret inventor, the fellow who invents a new can opener, the fellow who tinkers around until he perfects a new door stop, the man who makes a new cigar lighter, the inventor who creates a new radio dial, the man who makes a new bottle cap, the man who makes a new self-striking ice pick, and dozens of other inventions? It isn't always the spectacular invention that "brings home the bacon." Indeed, it is usually the small invention, which, if it finds a market, is likely to make its owner rich. And usually the big corporations, with their research laboratories, do not waste much time on these small inventions. They leave that to the garret inventors, and there are thousands and thousands of them in this country, who reap their yearly rewards with their small, but practical and necessary inventions.

And let no one think that these inventors are decreasing in number Quite the contrary. They are busier than ever, and their successes are getting more and more pronounced as years go by. The weekly Patent Gazette, where hundreds of such inventions are described and recorded from week to week, bears glowing testimony to this.

The Case

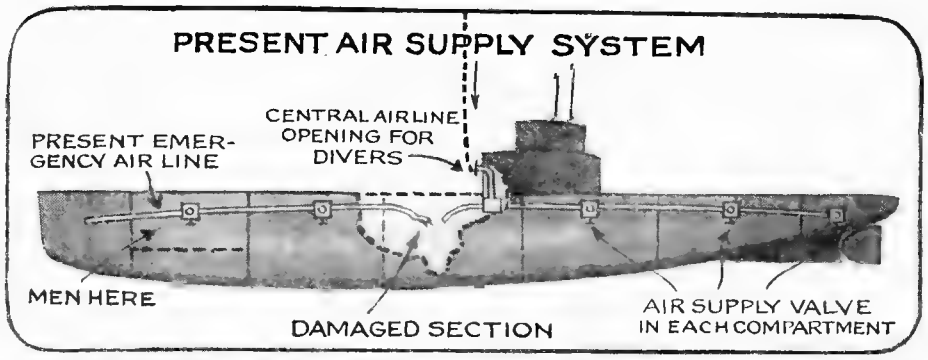
The Present Article Deals with Buoys, and Other Devices—Opinion of Them

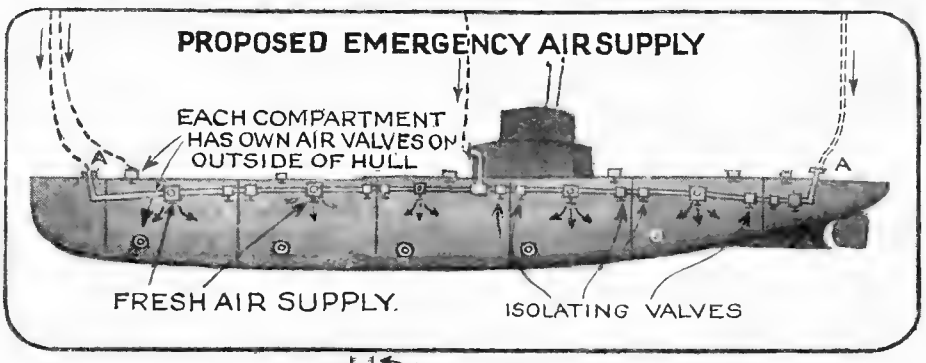
By H. WINFIELD

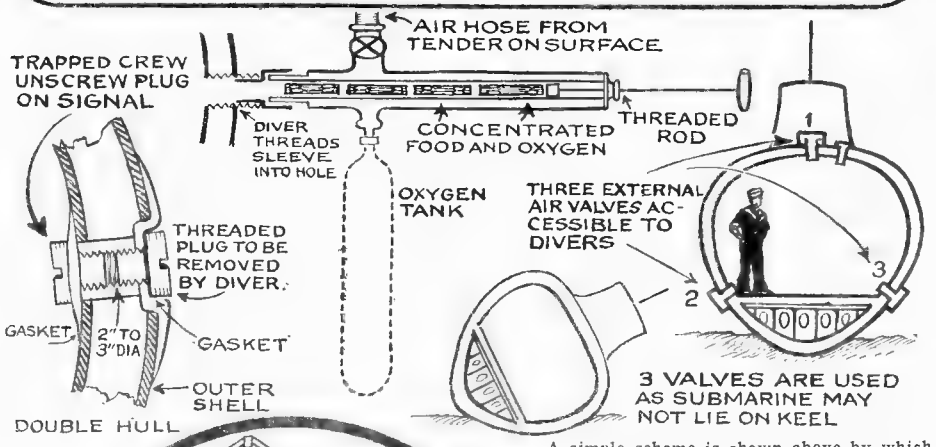
THE editors have been flooded with all kinds of ideas submitted by readers for rescuing the crew of the sunken submarine S-4, as well as raising the vessel itself. Some of the best ideas submitted are here discussed, with the Navy Department's objections to most of them. In a recent interview with one of the U. S. Navy Department's officers stationed at New York, a great many of the submarine salvage ideas and crew rescue methods here illustrated were discussed. This officer stated that out of several thousand ideas submitted by various civilian inventors, only two of the suggestions proved to be new and really worthwhile. These ideas had been forwarded to the naval officers in charge of the salvaging of the S-4 off Provincetown.

WHY NO TENDER BOAT WAS USED

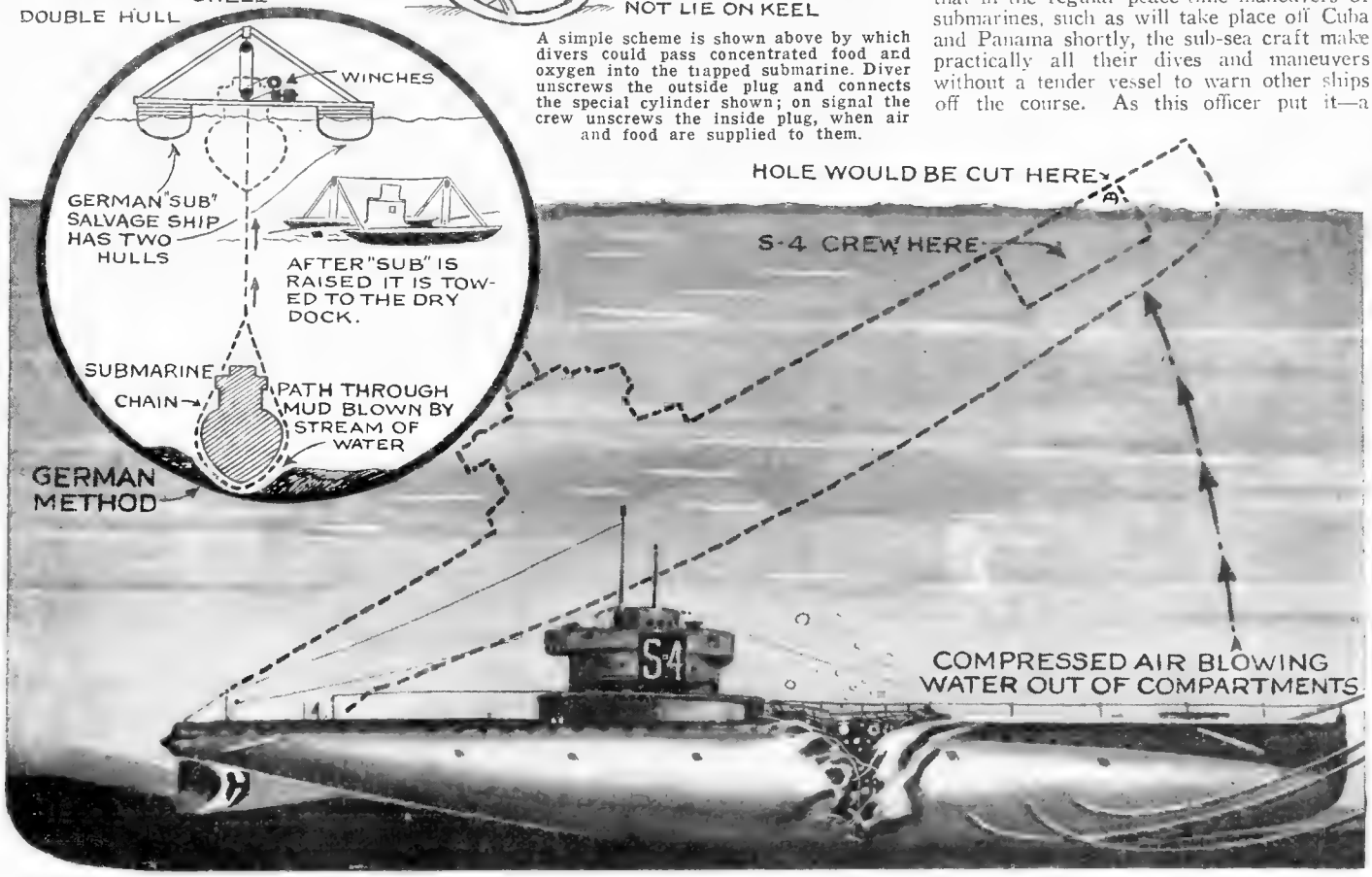
THE public press has been very caustic on the point that the submarine S-4 should never have undertaken a practice dive off Provincetown, R. I., without a tender ship on the scene, to warn other vessels off the course. Other criticisms have been to the point that the Coast Guard Destroyer *Paulding*, which rammed the S-4 and caused it to sink within a few moments, had no business in that vicinity at the time. As was pointed out by the naval officer whom the writer interviewed, the Navy Department does not usually operate in conjunction with the Coast Guard, which may or may not be a partial excuse for the sinking of the S-4; and further, it was stated that in the regular peace-time maneuvers of submarines, such as will take place off Cuba and Panama shortly, the sub-sea craft make practically all their dives and maneuvers without a tender vessel to warn other ships off the course. As this officer put it—a


PRESENT AIR SUPPLY SYSTEM
PRESENT EMERGENCY AIR LINE
CENTRAL AIR LINE OPENING FOR DIVERS
MEN HERE
DAMAGED SECTION
AIR SUPPLY VALVE IN EACH COMPARTMENT





A simple scheme is shown above by which divers could pass concentrated food and oxygen into the trapped submarine. Diver unscrews the outside plug and connects the special cylinder shown; on signal the crew unscrews the inside plug, when air and food are supplied to them.


WINCHES
GERMAN "SUB" SALVAGE SHIP HAS TWO HULLS
AFTER "SUB" IS RAISED IT IS TOWED TO THE DRY DOCK.
SUBMARINE
CHAIN
PATH THROUGH MUD BLOWN BY STREAM OF WATER
GERMAN METHOD
HOLE WOULD BE CUT HERE
S-4 CREW HERE
S-4
COMPRESSED AIR BLOWING WATER OUT OF COMPARTMENTS

German method of using a twin-hull submarine salvage craft is shown in circle. If sufficient water could have been blown out of S-4, bow would have come up, as shown.

of the S-4

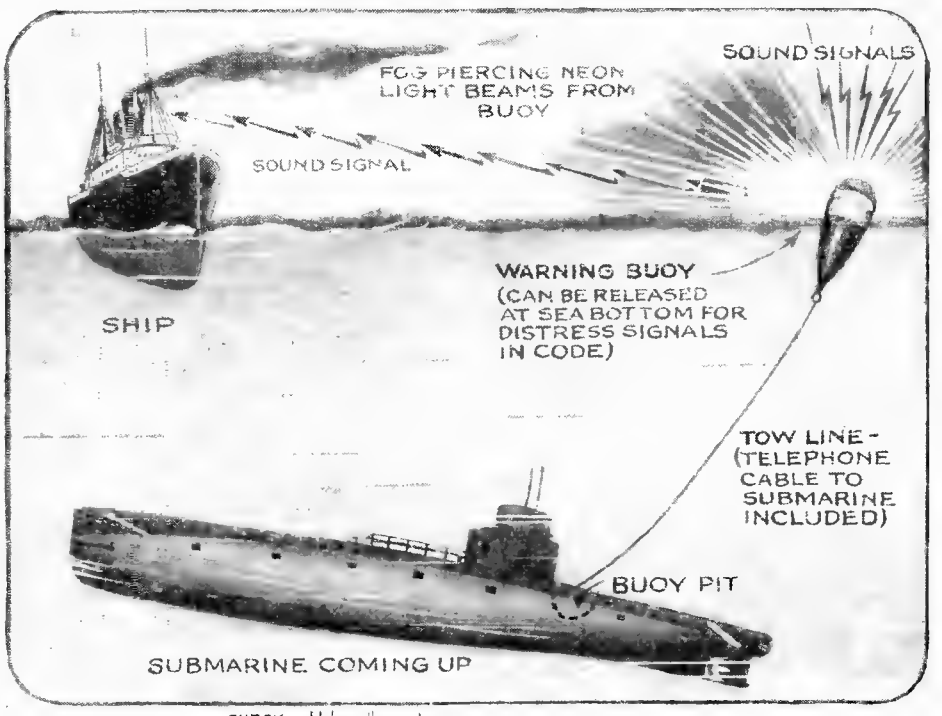
Lifting Eyes, Compartment Valves, and the Navy Department's Is Also Given

SECOR

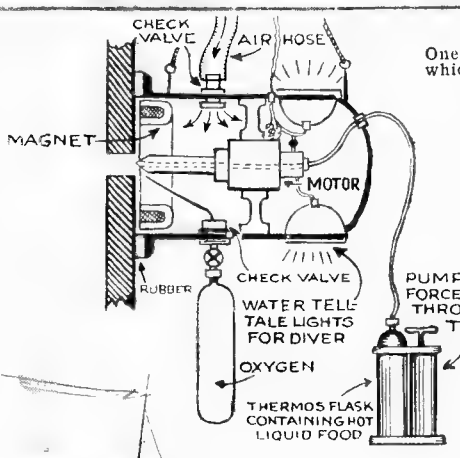
submarine which cannot take care of itself in wartime without a tender standing by, is a pretty useless weapon. But in peace time it is not apparent just why the boat's course should not be patrolled.

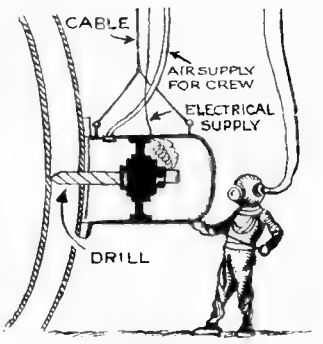
In view of the fact that there is apparently no positive form of signal now in use on U. S. submarines, which indicate when a sub-sea vessel is about to come up and break the surface of the water, this argument does not sound so good. The Navy spokesman stated that even though Prof. Fessenden stressed the use of the sub-sea oscillator for sending sound wave signals under water, as well as the fact that submarines are supposed to have sensitive listening devices for hearing the propellers on ships a mile or more away, that owing to the noise of the submarine's own propeller, and other extraneous noises such as surface or wave action, that a man stationed at a listening post on the S 4 for example, probably could not have heard the churn of the propellers on the rapidly approaching destroyer Paulding. As all of the crew were lost, it will probably never be known whether a man was listening for an approaching vessel. It is usually necessary to stop the propeller on the listening ship in order that the sounds from another ship's screws can be clearly heard. It is of course not feasible to stop all the machinery on a submarine when it is rising toward the surface, as the screws have to be kept going. A submarine does not normally rise straight up or down, but is kept in motion by means of the screws as it is coming up or going down, the angle at which the bow is pointed being determined by the position of the steering vanes fore and aft.

(Continued on next page)

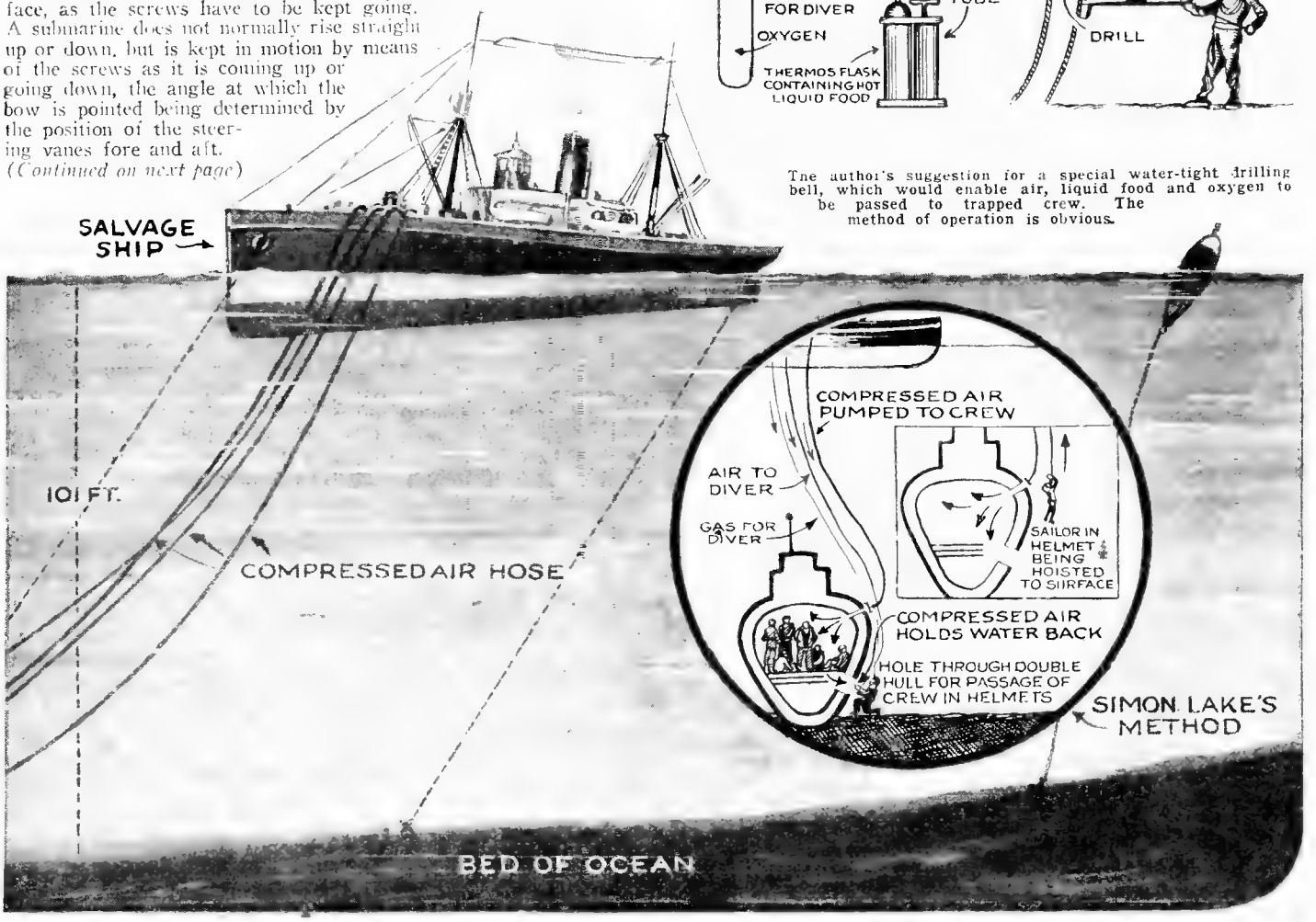

FOG PIERCING NEON LIGHT BEAMS FROM BUOY
SOUND SIGNALS
SOUND SIGNAL
WARNING BUOY (CAN BE RELEASED AT SEA BOTTOM FOR DISTRESS SIGNALS IN CODE)
SHIP
TOW LINE - (TELEPHONE CABLE TO SUBMARINE INCLUDED)
BUOY PIT
SUBMARINE COMING UP

One inventor's scheme of a marker buoy, which could also be released as a warning signal when rising.

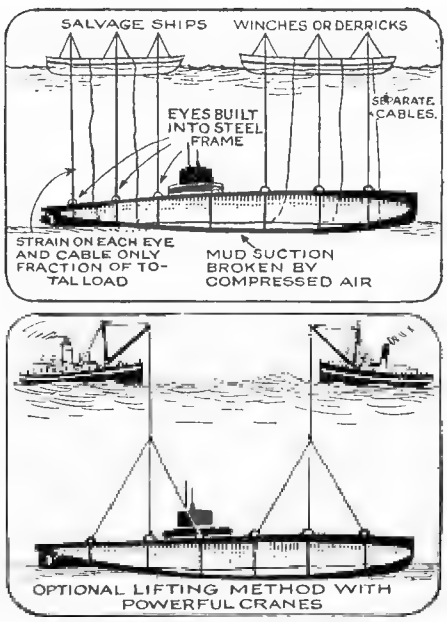




The author's suggestion for a special water-tight drilling bell, which would enable air, liquid food and oxygen to be passed to trapped crew. The method of operation is obvious.


SALVAGE SHIP
101 FT.
COMPRESSED AIR HOSE
COMPRESSED AIR PUMPED TO CREW
AIR TO DIVER
GAS FOR DIVER
SAILOR IN HELMET BEING HOISTED TO SURFACE
COMPRESSED AIR HOLDS WATER BACK
HOLE THROUGH DOUBLE HULL FOR PASSAGE OF CREW IN HELMETS
SIMON LAKE'S METHOD
BED OF OCEAN

Simon Lake's method of rescuing the trapped men on the S-4 is shown in the circle; this is a good method where compressed air can be pumped into the occupied compartment.


SALVAGE SHIPS
WINCHES OR DERRICKS
EYES BUILT INTO STEEL FRAME
SEPARATE CABLES
STRAIN ON EACH EYE AND CABLE ONLY FRACTION OF TOTAL LOAD
MUD SUCTION BROKEN BY COMPRESSED AIR
OPTIONAL LIFTING METHOD WITH POWERFUL CRANES

Two optional methods suggested for raising submarines by means of cables attached to eyes or rings securely fastened to the framework of the vessel. The principal point is to have a sufficient number of rings.

LIFTING EYES—PRO AND CON

SEVERAL thousand civilian inventors have sent to the editors of this magazine, newspapers and to the Navy Department, the idea that suitable lifting eyes or hooks should be placed on all submarines, so that in the event that one of these craft becomes crippled and lies on the bottom, divers can quickly descend and hook on cables and the submarine lifted.

The Navy Department's emphatic reply to this proposition is to the effect that eye-bolts were fitted into the frame of submarines some years ago, on the smaller size craft; but in actual tests they did not prove successful. Several years ago one of the submarines so fitted with eye-bolts sunk, and when the cables were attached to the lifting eyes, some of the bolts pulled out; and further, the submarine broke up, drowning all the crew. The naval experts point out that this submarine was a much smaller craft than the modern type, and they are not, therefore, at all desirous about trying eye-bolts or hooks for attaching cables to the extremely heavy modern submarine craft.

It is the idea expressed by many civilian engineers however, that if a sufficient number of eye-bolts were placed on the submarine, these bolts being properly anchored in a well designed frame; that a sufficient number of cables could be attached to subdivide the strain, and thus safely lift the submarine. It probably would be necessary in many cases, to break the mud suction by means of high pressure water streams, when the lift was to be made.

VALVES IN EACH COMPARTMENT

THERE probably never were so many people imbued with the same idea, as in the case of the S-4 disaster, when one out of every three people we met, strongly suggested that the men trapped in the torpedo room of the S-4 could have been saved, if each of the separate compartments in the submarine had been fitted with a valve communicating with the external shell.

The idea of these separate compartment valves is of course, that the diver simply has to unscrew a plug, for example, and connect an air hose from a salvage boat above.

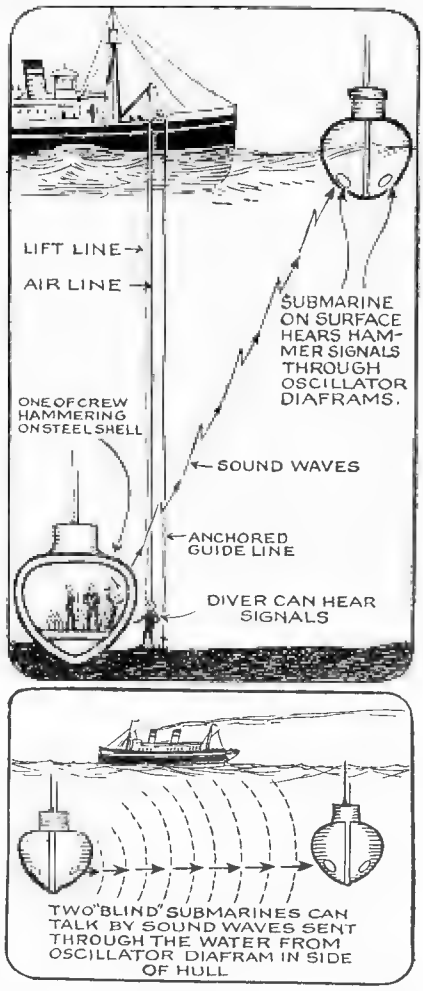
Another idea in this direction is that liquid food could be sent down the hose at intervals, and the men thus kept alive indefinitely, or until it was possible to raise the submarine and rescue them.

The objection of the Navy Department to placing valves in every compartment is that there are so many valves on modern submarines, that these additional salvage air valves in every section of the submarine would cause still more trouble from leaks whenever a submarine dives, or even under normal conditions when running awash.

As our drawings clearly indicate, the S-4 had a salvage air line running to all the compartments in the vessel, this common air line communicating with an external valve on the conning tower, which was available to divers descending to the wreck.

If a submarine accidentally sinks ordinarily, without badly being damaged in the mid-section, as was the S-4, due to being rammed by the destroyer *Paulding*, then this common air relief line, running to all the compartments, is a fine idea.

In the case of the S-4, as will be remembered, this salvage air line was ruptured


LIFT LINE
AIR LINE
SUBMARINE ON SURFACE HEARS HAMMER SIGNALS THROUGH OSCILLATOR DIAFRAMS.
ONE OF CREW HAMMERING ON STEEL SHELL
SOUND WAVES
ANCHORED GUIDE LINE
DIVER CAN HEAR SIGNALS
TWO "BLIND" SUBMARINES CAN TALK BY SOUND WAVES SENT THROUGH THE WATER FROM OSCILLATOR DIAFRAM IN SIDE OF HULL

How hammer knocks on the hull of the S-4 were picked up by the oscillator diaphragms, mounted in the hull of the submarine S-8, floating on the surface. Lower diagram shows how one "sub" communicates with another by under water sound waves.

when the *Paulding* struck the unfortunate craft, and it was discovered after several hours that the air being pumped into this common pipe line was not reaching the men entrapped in the torpedo room in the forward part of the submarine. An unsuccessful effort was made to repair the damaged air line by means of a piece of hose.

It is the firm belief of the editors that in spite of all the arguments against the compartment air valves by the Navy Department, and to which divers could connect air lines in case of an accident ;that these could be properly designed and provided with suitable tell-tale signals, so that the commanding officer on the submarine would know at all times, whether these valves were fully closed or not. The naval officer whom the writer interviewed at New York, agreed that this idea of the individual compartment valves was a good one, and he could not see why this should not be employed. He pointed out to the writer, however, that the common salvage air line on the S-4, had more than one external opening to which divers could connect air supply lines; in spite of this, however, nothing could be done for the men in the torpedo room of the S-4, owing to the rupture of the vital part of the emergency air system, as was aforementioned. A valve in each compartment would have saved the six men in the torpedo room; that seems certain.

SUPPLYING AIR THROUGH SIGNAL TUBES

ABOUT four and one half days after the S-4 went down off Provincetown, and at a time when no further signals were heard from the trapped men, the divers were able to pump air into the torpedo room through the S-C signal tubes. The diaphragm on the hull was removed for this purpose and air forced in through the small metal tube leading into the torpedo compartment.

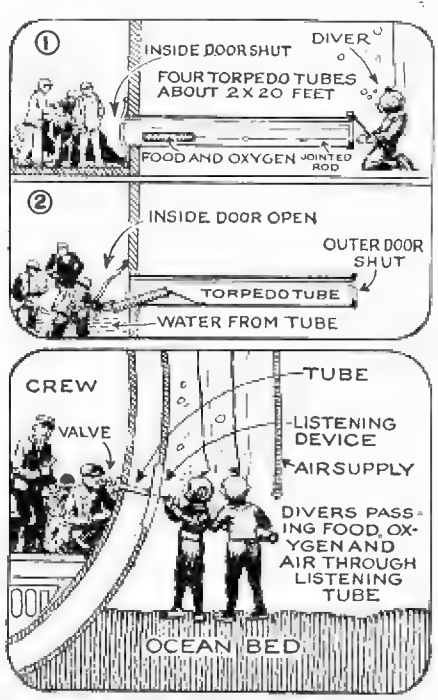
The great question now arises of course, as to why this was not done during the first twenty-four hours after the submarine went down, when divers were sent down. Not only was air finally pumped into the torpedo room through the small signal tube, but samples of the air were periodically trapped and analyzed, in order to determine the amount of poisonous carbon dioxide in the air coming from this chamber. The testimony of Lieut. Commander Ellsberg before the Naval Court of Inquiry, showed that signs of life (taps) from the torpedo room had been obtained by the diver on the day after the S-4 sunk. Commander Ellsberg blamed rough weather for the delay in passing air through the signal tube.

RAISING THE S-4

AS the illustration at the start of this article shows, the first idea uppermost in the naval officers' minds was to try and raise the bow end of the sunken submarine by attaching several air lines, so as to blow out any water in the compartments; and thus by making the submarine sufficiently buoyant, enable it to rise, at least one end of it; all or most of its normal buoyancy thus reestablished.

After pumping air into the submarine for some time, it was decided that owing to the damage to the S-4, this condition would not occur, and the next plan was to use the pontoon method of raising the submarine.

(*Continued on page* 1055)



Two schemes which might have saved the lives of the S-4's crew. First—diver supplies food through torpedo tube; second—oxygen and liquid food fed through S-C signal tube.

Thought "Konzentrator" Latest Swindle

German Device Supposed to Stimulate Thoughts, Actually Does So—But Not the Way One Expects

By HUGO GERNSBACK

Member American Physical Society

THAT Barnum was right, and will be right for generations to come, is best proven by the scientific fakes and swindles that seem to be on the increase, rather than on the decrease. As Barnum said, "The public likes to be humbugged," seems to hold just as good in this day, except that more fools seem to be born now than ever before. If there were not, all of the fake devices that seem to abound could not exist. We have exposed many scientific swindles in the past, but the one that we present to the unenlightened world today possibly takes the prize.

IN some of the other devices we exposed, at least there may always be some remote question in someone's mind that "there may be something to it after all." In some of those which we have described and exposed in SCIENCE AND INVENTION, there was at least some force, such as electricity or magnetism—always the ever mysterious—that was lurking behind some shiny knob or that could be attached to a light socket, and at least give a physical demonstration that something actually happened in the device. But *The Thought Konzentrator*, a German device, which is now being imported into this country, is without doubt the most preposterous piece of bunk that ever came to these shores. For the Konzentrator actually does nothing, neither electrically, nor any other way, that it is possible to ascertain in a physical laboratory.

THE KONZENTRATOR'S "INSIDES"

THE Konzentrator is composed of a neat leather strap, two nice gilt discs, about 2 inches in diameter, and a small capsule, which upon analysis proved to be colored glycero-gelatine, a well-known substance. The two side discs are supposed to be worn over the temples, but the metal does not touch the temple itself, for there is a cork disc face, over which runs a piece of German silver wire, as shown in the illustration. Actually, only the two German silver wires touch the temples. There can be no electrical action, because there is no electrical circuit; simply because the metal discs have no connection with each other, being very nicely insulated by the cheap leather strap that goes against the forehead. A piece of mercerized tape holds the device to the temples.

ON opening the discs, one finds that the piece of German silver wire which goes around the cork is not designed to make contact with the metal discs themselves; so whatever the action of the German silver wires is, it certainly is not electrical, it is not magnetic, it certainly is not chemical—in short, it is nothing that anyone knows anything about or likely ever will.

The capsule that is placed on the center of the forehead and which, as we said before, contains the colored glycero-gelatine, does not make direct contact with the forehead itself. Instead, the gelatine is contained in a shallow metal capsule, as shown in our illustration. Over this goes a cover, which is perforated. What mystic or cabalistic effect this glycerine is supposed to produce, is a deep secret. No one is to know anything about it. The action of this glycerine certainly is neither electrical or chemical, nor has it any other action that manifests itself in any laboratory tests, as performed by us.

Yet, harken to what the famous Konzentrator will do for you. When the device was first advertised, we promptly sent for one, paying $10.00 for it. The device is for sale by the Novom Chemical Company, 131 West 41st Street, New York City, whose letterhead states that they are importers and makers of *Psycho-Physico Accessories*.

G. C. B. Rowe demonstrating how the "Konzentrator" is worn. This simple device is claimed to stimulate thought and perform the other seven wonders.

Do not loan your apparatus to others. Keep it for your own self. Read the enclosed Directions carefully and you will have the power to seek. Use it in study. We all need more and better brains. Study without concentration is useless. Konzentrator makes the brain receptive and the memory retentive. Its electro-magnetic action upon the brain mass and the pituitary gland create vibrations, which will allow you in the silence to swing into the cosmic infinite.

Please spread the good news and help us to serve others as we had the honor of serving you.

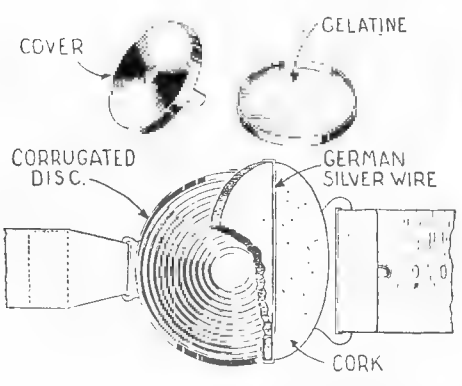
Most sincerely yours,
NOVOM CHEMICAL COMPANY,
(s) J. E. Acker,
Owner.

The following "directions," too, came from the Novom Chemical Co.:

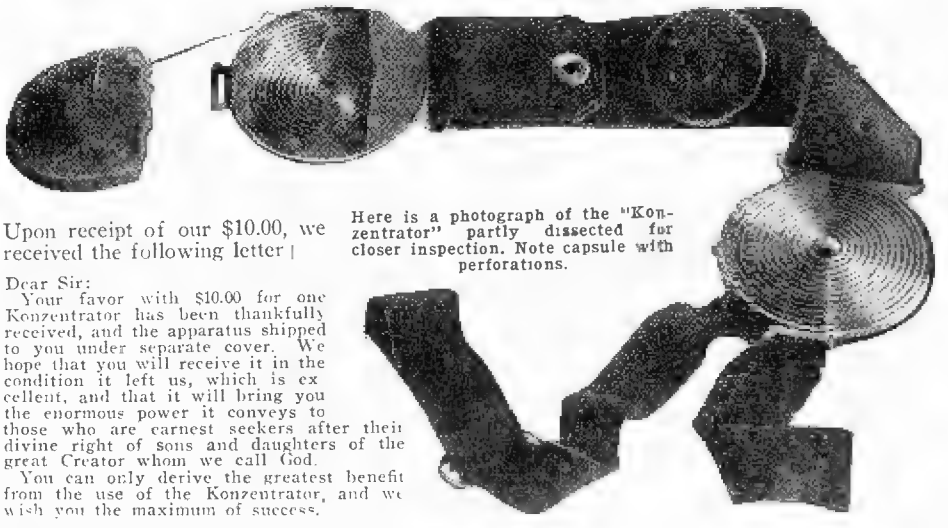
THE KONZENTRATOR

An invention of one of the most prominent German Scientists in the field of Psycho-Technical

(*Continued on page* 1060)



The details of the "Konzentrator." A corrugated metal disk lined with a cork stopper, around which there is a piece of German silver wire. It is held in a head-band, in the center of which we find a capsule containing colored gelatine.



Here is a photograph of the "Konzentrator" partly dissected for closer inspection. Note capsule with perforations.

Upon receipt of our $10.00, we received the following letter:

Dear Sir:

Your favor with $10.00 for one Konzentrator has been thankfully received, and the apparatus shipped to you under separate cover. We hope that you will receive it in the condition it left us, which is excellent, and that it will bring you the enormous power it conveys to those who are earnest seekers after their divine right of sons and daughters of the great Creator whom we call God.

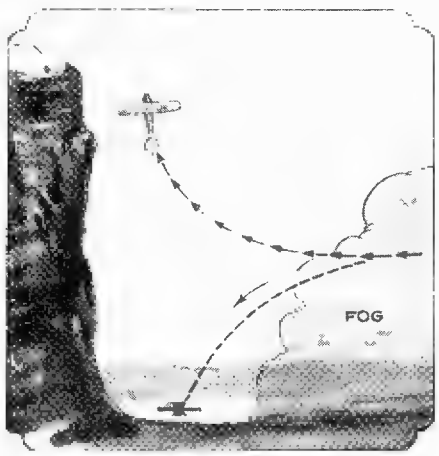
You can only derive the greatest benefit from the use of the Konzentrator, and we wish you the maximum of success.

FLYING BLIND

For First Time an Aviator Lands in a Complete Fog, Guided Only by Instruments, Thanks to New Ocker-Myers Flying System

By G. K. SPENCER

THE threshold has been crossed! A human flyer has successfully and safely landed a flying machine entirely blind in a dense fog by the guidance of instruments, instruments on which further experiment is already being pushed so that



The pilot coming out of the fog, was so completely fooled by his "flying senses," that he thought he was about to land the plane at the spot marked X; instead, he finally discovered that he was flying "vertically," and almost wrecked the plane on a cliff.

every man or woman who flies, may with perfect safety enter and pass through fogs without interruption to the aerial journeys.

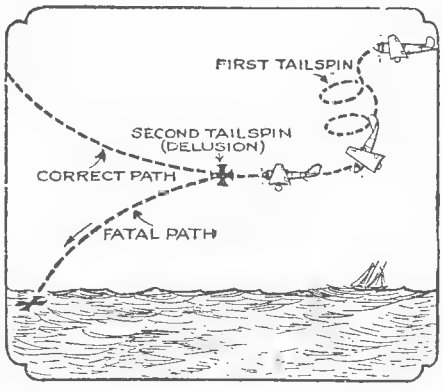
EAR CANALS FOOL FLYER'S BRAIN

The significance of this statement may not be of as great import to the average citizen, as it is to all the military and commercial flying personnel, who today must suspend their flights the moment fog becomes thicker and more extensive than may be flown through in a few minutes.

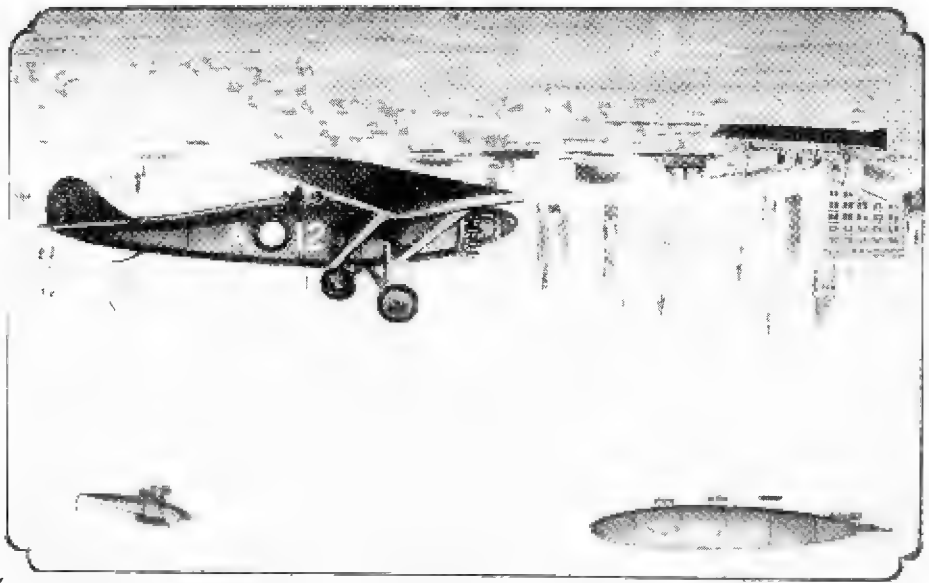
BIRD'S FLYING SENSE NOT PERFECT

Flying at all military fields is suspended when fog descends; the intrepid pilots who carry the air mail, upon encountering extensive fog always land and await an opportunity to break through to their destinations. Civil pilots everywhere recognize the peril of flying through fog, with all land and sky marks obliterated, with the natural horizon clouded from view. They know that no human being can fly more than a few minutes in such a fog, *without losing all sense of position; without encountering vertigo, which causes the vestibular canals of the inner ear to deliberately lie to the brain; to tell the brain it is flying* RIGHT *when in reality the flight is* LEFT, to tell it that *ascension* is being made, when in truth the air machine is *diving* dangerously to the surface below

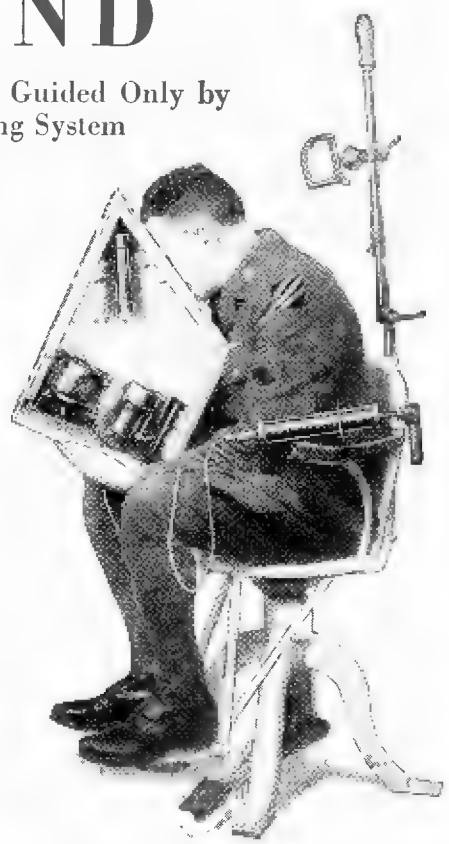
Until the experiments brilliantly conducted at the Presidio of San Francisco by Captain William Ocker, oldest flying officer of the Army Air Corps, and Captain D. A. Myers, Flight Surgeon of the same Command, it has not been realized that even the birds of the air suffer the same limitations as human beings in attempting to fly through dense fogs, that even sea-gulls and pelicans are found dead along the beaches after every great fog, killed as they flew in apparent security, downward, only to be crushed as they met the earth while their *flight sense* informed them they were flying safely.



Relying on "flying sense," one of the Pacific fliers undoubtedly flew into the ocean, instead of upward; due to the delusion of having been in a second tail spin.



This picture, corresponding to that on the front cover, shows how a city appears when a pilot is flying upside down. Due to the tricky action of the human senses, the pilot may only "think" he is flying upside down, and meet with disaster in consequence.



New revolving chair in which airplane pilots are tested. As long as the pilot concentrates on the navigation instruments, all is well.

NO "INHERITED" FLIGHT SENSE

In truth, there is no inherited *flight sense.* This from Captain Ocker, who has been with the United States Army since 1898, one of the first Army pilots, who learned the elements of flying in the first Curtiss flight school, and who was General William Mitchell's personal pilot (though the General himself was one of the good ones) while that officer was assistant chief of the Air Service at Washington. No instinctive flight sense exists—even birds lack it. They fly mechanically, and every human who flies must do likewise, relegating what *feel of the air* he may have to a secondary but valuable position.

"FLYING BLIND" BY THE NEW OCKER-MYERS SYSTEM

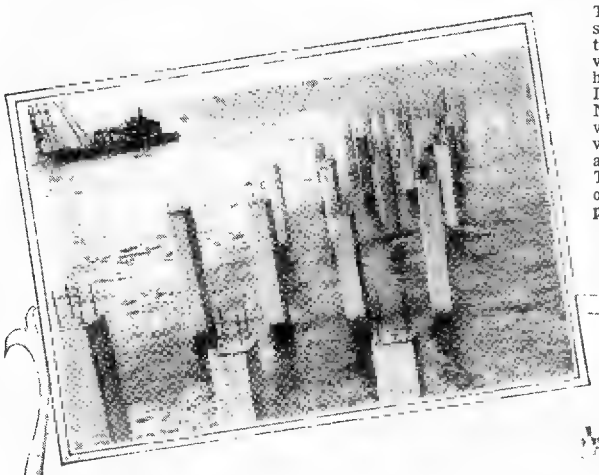
After experimenting with more than 600 individual pilots, the first commercial tests of the Ocker-Myers system of flying were made with the pilots of the Pacific Air Transport, a company conducting the Air Mail lines between Los Angeles and Seattle, Washington, over the most extensive fog belt in the United States. The pilots of this company had been taking off in fogs, when telephonic reports from further along the coasts gave assurance that after a reasonable distance there was a lift in the great Pacific fog fields.

Ever such take-offs possessed their element of danger, but the mails had to go through, and the persistence of fog during certain hours of the Pacific day, told us that if the planes did not take off many times while fog covered the Pacific slope, there would be no effectual air-mail service for the western coast cities.

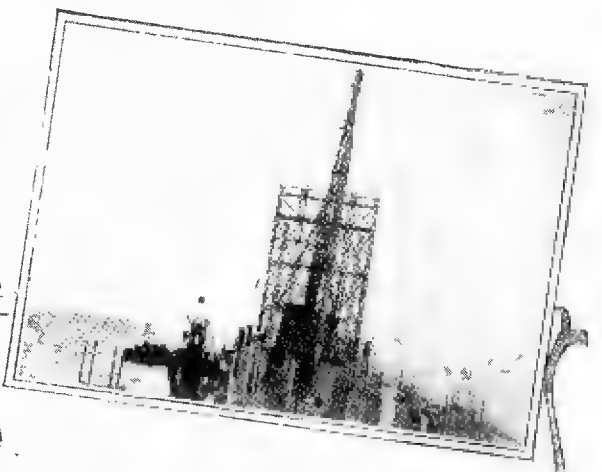
Accordingly, the Pacific Air Transport, which by permission of the Army Air Corps has its San Francisco terminal on Crissy Field, Presidio of San Francisco, was chosen for the first commercial experiments, and all the pilots of the company were instructed personally by Captain Ocker in the mechanics of what he wished accomplished, and by Surgeon Myers in the principal in-

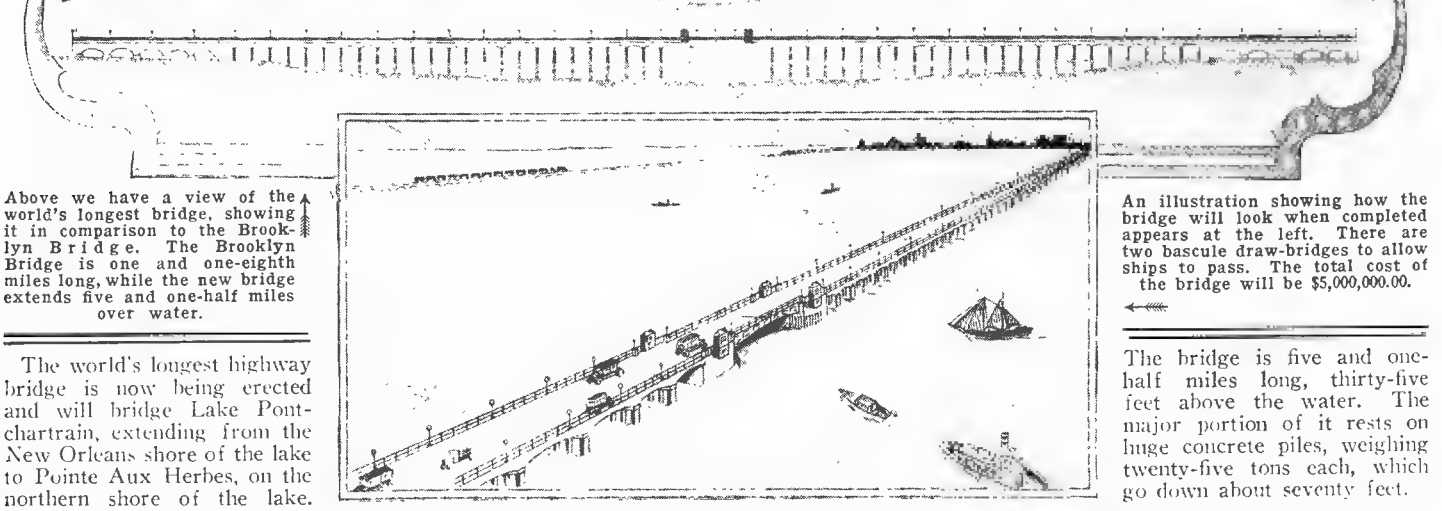
(*Continued on page* 1031)

Longest Concrete Bridge at New Orleans



The photo at the left shows one of the stages in the construction of the world's longest concrete highway bridge across Lake Pontchartrain, in New Orleans. At the left we have a view of the world's largest pile-driver at work on the new bridge. This machine drives four of the eighty-foot concrete piles at one time, driving two alternately.
—Illustrations courtesy New Orleans Assoc. of Commerce





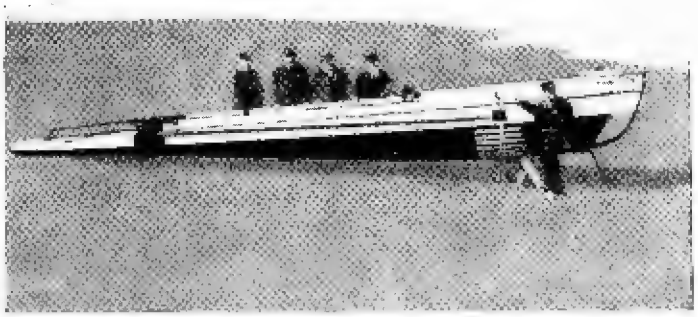
Above we have a view of the world's longest bridge, showing it in comparison to the Brooklyn Bridge. The Brooklyn Bridge is one and one-eighth miles long, while the new bridge extends five and one-half miles over water.

An illustration showing how the bridge will look when completed appears at the left. There are two bascule draw-bridges to allow ships to pass. The total cost of the bridge will be $5,000,000.00.

The world's longest highway bridge is now being erected and will bridge Lake Pontchartrain, extending from the New Orleans shore of the lake to Pointe Aux Herbes, on the northern shore of the lake. The bridge is five and one-half miles long, thirty-five feet above the water. The major portion of it rests on huge concrete piles, weighing twenty-five tons each, which go down about seventy feet.

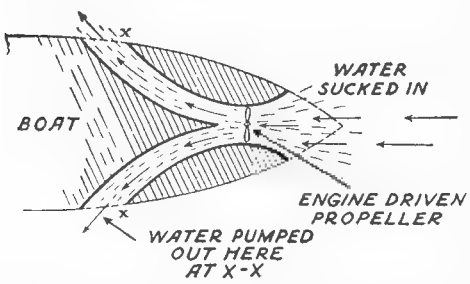
New Boat Propelled Like Fish

A NEW, yet remarkably efficient system of propelling boats has recently been invented by A. Boerner, of Germany. Taking his observations directly from fishes, the inventor was convinced that the gills of the fish serve for propulsion, the expelled water flowing along the sides of the body, thus driving the fish ahead. The fins serve for the maintenance of equilibrium and the tail as a starter and rudder. The fish draws water, not only for breathing, but also for swimming and drives it out through the gills with increased velocity. The fish therefore interposes a medium between his body and the resistance of the water. Following out this line of thought, the inventor constructed his test ship, which is entirely different from all other boats. A screw propeller is located in the bow, in a funnel-shaped opening beneath the water. This specially constructed turbine, with a high speed of rotation, reproduces the mouth and gill action of a fish. The water is sucked in by the turbine and driven out again. By passing through the openings on the side of the ship, the water creates a sort of whirlpool, which breaks against the corrugated side of the boat and produces an effect of two streams of water passing along the sides. By this operation, the bow resistance, which is created by the rapid movement through the water, is greatly reduced. It is interesting to note that in the eighteenth century Bernoulli, and later the Englishman, Rumsey, organized experiments of the same kind, which were shattered by the highly developed pessimism of the day.

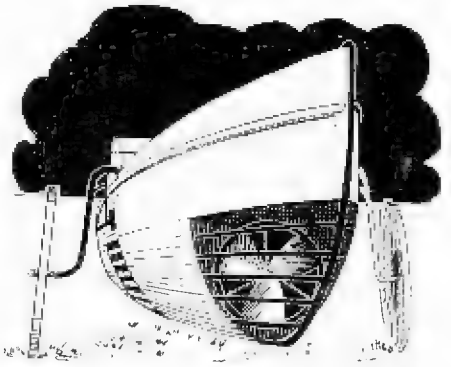


Above is a photograph of the new boat, with the inventor, A. Boerner, who built it. He conceived his idea by observing the movements of fast swimming fishes. The boat has a screw propeller located in the bow, in a funnel-shaped opening beneath the water line

The economical importance of the Boerner effect is shown by the saving of seventy to eighty per cent of the power or the attainment of higher speed. This invention may be regarded as marking the birth of a revolutionary step in the line of boat propulsion, which may be of great practical importance. It is marked by great ingenuity in its simplicity and its foundation is not one of mathematics, but of nature. Taking his observations directly from the fish, the inventor has thus been able to build a boat, which is propelled through the water in much the same way as is the fish. On either side are gill-like openings.



The above diagram shows the action of the propeller placed in the bow of the boat. It is identical with that of the fish. On either side of the boat are openings corresponding to the gills of a fish.



Above we have a view of the boat from the front, showing the location of the propeller and the gill mechanism. The whole arrangement works like a pulsometer.

Can Siamese

Is Life for One

By JOSEPH H.

Fig. 1. Here is a photograph of the Hilton twins as they appear on the vaudeville circuit. Even though joined together by nature, by an inseparable bond which can only be severed in event that one of the twins should happen to die before the other, they do not look exactly alike. An X-ray photograph of these twins would disclose that they both had distinct pelvises, but that the connection which holds them linked together is a union of the bones at the lower part of the spine, specifically the sacrum and coccyx. Speedy surgical intervention in case of the sudden departure from this life of one of the twins, is the only means of saving the other. No one can prognosticate the end results.

THE name, *Siamese Twins*, is given to practically every form of double-growth in the human race, regardless of how the twins may be joined together. The name dates back from the two youths, Eng and Chang, who were born of Chinese parents in Siam, in the year 1811. They traveled with circuses for many years, and lived to the ripe old age of sixty-three. They popularized the term Siamese Twins, and now every congenitally joined twin is popularly called a Siamese Twin, regardless of whether the twins are joined back to back or side to side.

In the original Siamese Twins, there was a band of flesh stretching from the end of one breast-bone to the same place on the opposite twin. Otherwise the twins were two distinct normal individuals.

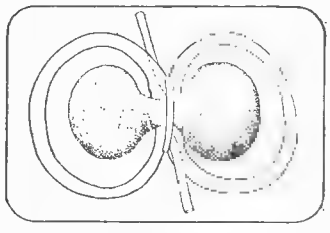


Fig. 2. Diagram indicates an ovum disturbed so as to separate the body into two portions. This may or may not be the cause of Siamese twins.

DIFFERENT STRUCTURE OF DOUBLE-TWINS

Having seen the reason for calling all conjoined beings Siamese Twins, and accepting the popular version of the term, we must, therefore, ask the question—which Siamese Twins does one desire to separate? If we are referring to the original, then the answer is "Yes, they can be parted." If we refer to twins like the Phillipino Twins, again the answer is "Yes"; but when we apply the term to the Hilton Twins, the Blazek Sisters, or to the Indianapolis Twins, the answer is emphatically "No." The latter group cannot be separated because of the eminent danger to either of the two parties. The only possibility of separation is if one twin should die before the other and the surgeons were prepared to operate immediately.

Ordinarily, Siamese Twins are two distinct characters. If one pricks himself with a needle, it has no effect on the other; if one eats or drinks food which does not agree with his constitution, the effect on the other is negligible. There is, of course, some inconvenience, because if one is too ill to remain out of bed, the other must lie down with the ill person; or if one twin develops an infection, the infection may be carried to the other through the bond of flesh (through the intermediary of the blood vessels and capillaries), which holds the two bodies in the position of their birth.

One cannot always be assured that even those twins joined together by a bond of flesh and with no bony junction whatever, can be separated without danger to each other. For instance, there are the Hindu Twins, Rodica and Doodica, who were joined in a fashion similar to the original Siamese Twins, and were divided by an operation in Paris, France, in February, 1902. Rodica survived the operation; her sister succumbed to tuberculosis.

Fig. 6. Whatever can happen in the animal kingdom can likewise occur in man. It is quite possible to have a two-headed human being. The photograph at the left shows a pig with three eyes, two mouths, two noses, and two tongues.

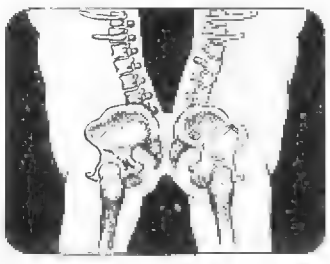


Fig. 3. The diagram here illustrates an X ray view of the Phillipino twins who show no bony connection. They could be separated.

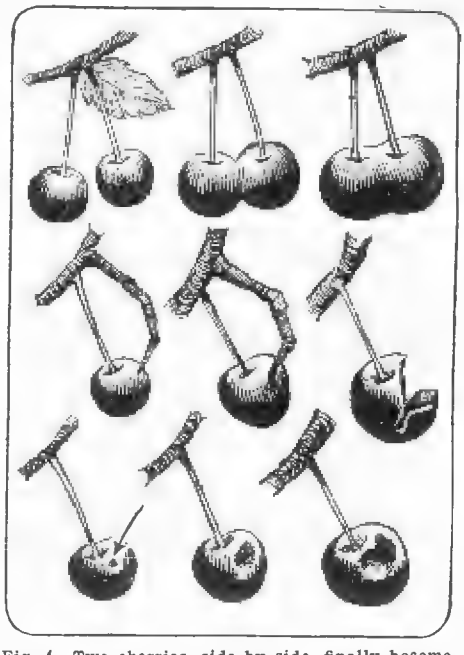


Fig. 4. Two cherries, side by side, finally become but one. This is a possible cause of Siamese births. Second row shows cherry mutilated by outside injury; third indicates growth of a birthmark.

PERCENTAGE OF SIAMESE TWINS BORN

Before proceeding further, let us try to determine exactly what takes place in the case of conjoined twins. There are many other malformations and many different types of monstrosities which develop, but their proportion is not very great. Malformations occur in from 1.55% to 2.83% births. The question as to the cause of these malformations is still a disputed one, but it may be mentioned here that maternal (mental) impressions as such a cause, can be definitely dismissed as a relic of those

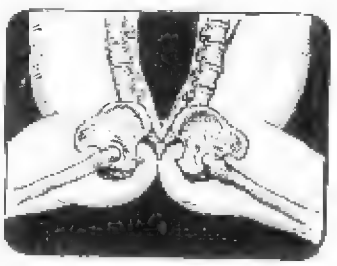


Fig. 5. Twins joined at the sacrum and coccyx are not unusual. The diagram indicates such a union. Separation quite impossible.

Twins Be Separated?

Possible Without the Other?

KRAUS

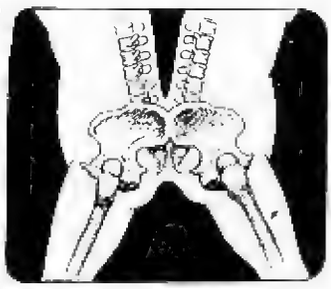


Fig. 7. An X-ray photograph of the Blazek twins which shows them joined together in the manner here indicated, with the ilia fused. They cannot be separated.

days when fantastic grounds were looked upon as being explanatory of all things unusual.

HOW TWIN GROWTHS FORM

It has been thought since earliest times that double or multiple monsters are the result of fusion of what were primarily two or more individual embryos. This view is explained in Fig. 4, showing the two cherries hanging from the twig of a tree. In the first view, and when the cherries are quite small, they are seen as distinctly separate fruits. As they grow, they touch each other, and from this point on, they become joined, producing a cherry with two pits and two stems, yet as far as the fruit is concerned, constitute merely one single cherry. The same course may take place in the kingdom of the mammals in which, of course, man is included. On the other hand, the twins may be what is known as unioval; that is, they are produced from one ovum. While commonly they become two separate entities and two individual personalities; due to some arrest in development, or due to some disturbance resulting in an abnormality of position, the two bodies may be fused. Thus there is on record a case in which there were two spinal columns, distinct to the pelvis; one column sustained two heads, whereas the other supported one head, giving us a typical three-headed monster. Triple monsters are quite rare.

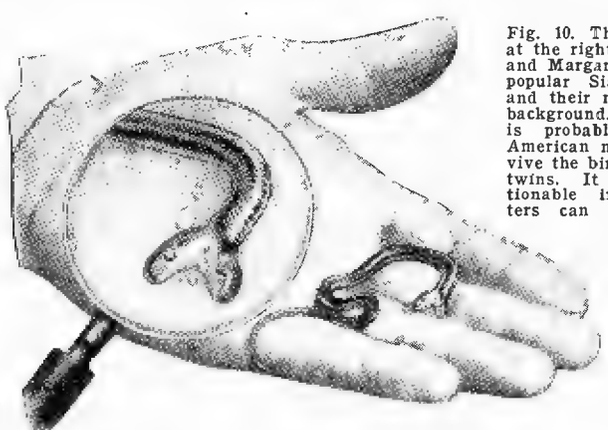


Fig. 11. The two-headed snake here shown differs from the two-headed baby, diagonally above, only by the fact that the one is human and has a double spinal column, while the other has only a double head.

TWO-HEADED PIGS AND SNAKES

Then there are those cases of double-headed monsters, some of which are double only, insofar as the head and neck is concerned; others which are double for a greater or a lesser portion of the spinal column. We find several examples of this on the accompanying pages. We see in Fig. 6 a two-headed pig, a two-headed snake, in Fig. 11, and a two-headed calf, in Fig. 16.

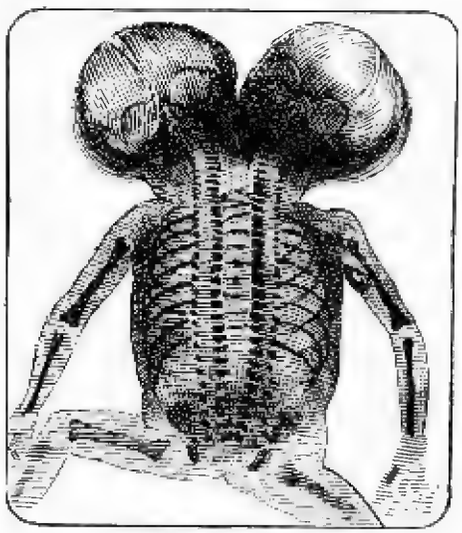


Fig. 8. It is unusual to find a two-headed human child with two complete spinal columns and but one pelvis, yet the diagrammed X-ray photo shows such an existence.

We can see a diagram tracing from an X-ray photograph of a two-headed human infant, which is also double for the entire length of the spinal column, but which has but one pair of arms and which has one pair of legs, in Fig. 8. Anatomically, we find that some organs are doubled in this infant.

It is interesting to note that in the case of the pig, there are two complete mouths and noses, each with its own tubal connection to the stomach and to the lungs, but this two-headed pig has only three eyes and the center eye does not seem to be double. In the case of the snake and also in the case of the human monstrosity, both heads are complete. The calf, on the other hand, can eat with either mouth, but cannot use both mouths at the same time. Unfortunately, this animal is blind in two eyes, but can see with the other two.

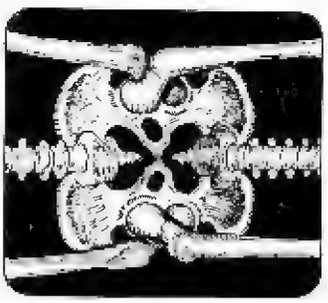


Fig. 9. This diagrammed X-ray gives a view of the Indianapolis twins. Here the bones are fused in the manner indicated. It is impossible to separate these twins.

Conversely, instead of having two or more heads on one or more spinal columns, attached to but one pelvis and with one complete set of extremities, we can have a single-headed, double-bodied human being. An example of this is illustrated in the diagram on the third page, Fig. 13, where there are two

Fig. 10. The photograph at the right shows Mary and Margaret Gibb, very popular Siamese twins, and their mother in the background. Mrs. Gibb is probably the only American mother to survive the birth of Siamese twins. It is very questionable if these sisters can be separated without danger to each other.

Siamese Twins—Their Separation

Fig. 12. Luicio and Simplico Godino, Siamese twins from the Island of Samar, here pictured entering a car they are about to learn to drive.

complete individual bodies joined to but one distorted head, and also joined at the sternum or breast-bone.

In this particular discussion we are primarily concerned with duplicities and triplicities rather than with those monstrosities of a parasitic nature, wherein a more or less perfectly formed body is attached to a well-formed individual, but has no separate existence and receives its nourishment wholly from the well-formed body.

It is quite obvious by what has just been said that it would be impossible to separate one of the heads from a double-headed individual. It also would be impossible to divide the double head of either the calf or the pig or to remove one of the bodies in the double-bodied animal indicated in Fig. 13. There are limits to modern surgery.

Again we return to the question—which twins can be separated? The answer is, primarily, those in which there is no bony connection and, secondly, those where there is a bony connection, but where the life of one or the other of the twins is in such danger that the separation is absolutely necessary for the welfare of the healthy one.

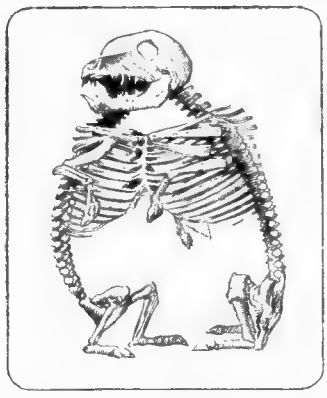


Fig. 13. It is possible to have a single-headed, double-bodied human being, just as it is possible to have a double-bodied single-headed animal, as the diagrammed X-ray shows.

One must remember, though, that practically every freak condition found in animals may find a counterpart in man.

Those very pretty and popular sisters known as the Hilton Twins are joined together at the sacrum and coccyx (end of spinal column), as illustrated in Fig. 15. The lower portion of the intestines join together in one common duct. While it is quite possible to separate them, it could only be done in event of the accidental demise of one of the sisters. What the outcome of such surgical interference would be, cannot be even hinted at.

Barring a possible surgical shock, the Phillipino Twins, who are joined together as indicated in the X-ray view in Fig. 3, could be parted from each other.

A very unusual case is presented by the Indianapolis Twins, indicated in Fig. 9. Here the inferior portions of the pelvis are fused with each other, so that one pair of legs of one twin lie beside the body of the other. It is extremely doubtful that either could survive, if surgical intervention was necessary. A similar state exists in the case of the Blazek Twins, indicated in Fig. 7, where they are joined together by fusion between the iliac (hip bone) bones.

Fig. 14. The old circus crowds probably remember the two-headed, double-bodied calf which was exhibited by P. T. Barnum. There is no record that an X-ray of this calf had ever been taken, nor is there any indication as to whether the calf was not a built-up freak. Nevertheless, it is quite possible to have an animal or a human being born in the form depicted in the above photo.

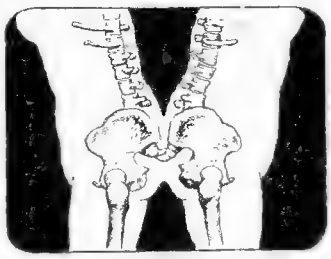


Fig. 15. An X-ray diagram of the connecting link between the Hilton twins.

Fig 16 (right). A two-headed calf which can eat with either mouth but not with both at the same time. It has four eyes, two of which are blind.

Fish Harvester

Modern Scientific Method of Wholesale Fishing

The illustration shows the proposed arrangement of equipment to be employed in a new method of wholesale fishing. It will be seen that there is nothing intricate about the construction of the apparatus, for it works upon the well-known principle that fish are attracted by light. It is estimated that a ship constructed as shown here will cost about $45,000.00.

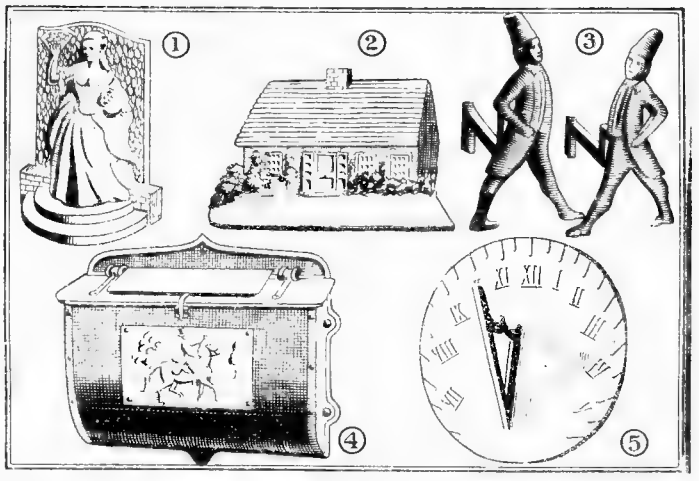
THIS fish harvester here illustrated and described will remove the last trace of romance connected with the ancient art of fishing. This revolutionary fishing apparatus is essentially the invention of Elwood Bleeker.

On the way to the fishing grounds, the chain and windlass hold the fishing equipment above the surface of the water. When a suitable site has been reached, the ship is anchored, or if the tide is not sufficiently strong, the ship is moved slowly forward with the metal net just below the surface. The fish in their attempts to get near the light, soon find themselves crowded into the conveyors by the forward motion of the boat or action of the tide and the guiding effect of the metal mesh. After leaving the conveyor at the deck, they simply fall into the hold, and the dangerous and disagreeable work of hauling and emptying the old-fashioned nets is eliminated. The rate at which fish are being caught is known at all times by simply watching the conveyors and no time is lost by dragging nets through fishing grounds which contain little or no fish.

This machine will be especially useful for catching fish which move in schools, at or near the surface, such as the herring. The use of this latest type of machinery for the wholesale harvesting of fish must be accompanied by corresponding intelligent activities to prevent the depletion of the present abundant supply of fish.

—Illus. courtesy of Scientific Fishing Association.

New Homecraft



The illustrations at the left show the type of small castings in grey iron, which may be obtained without the usual sharp edges, which gives a desirable appearance of antiquity. Fig. 1 is a book-end, 2 is a door stop, 3 shows a pair of andirons, 4 is an iron mail box and 5 is a sun dial.

THE castings should be decorated with ordinary oil colors sold in tubes, or with the various shades of bronze, enamel or liquid sealing wax. A coating of white paint is applied and allowed to dry before the decorating medium is applied. The surface of the castings is smooth and hard, sharp lines are omitted to imitate the antique. Castings may be obtained in the form of andirons, door knockers, candlesticks, candle sconces, book-ends, door stops, and many other decorative forms.

The illustration below shows a girl engaged in the pleasant work of decorating one of the small castings which are supplied in many forms.

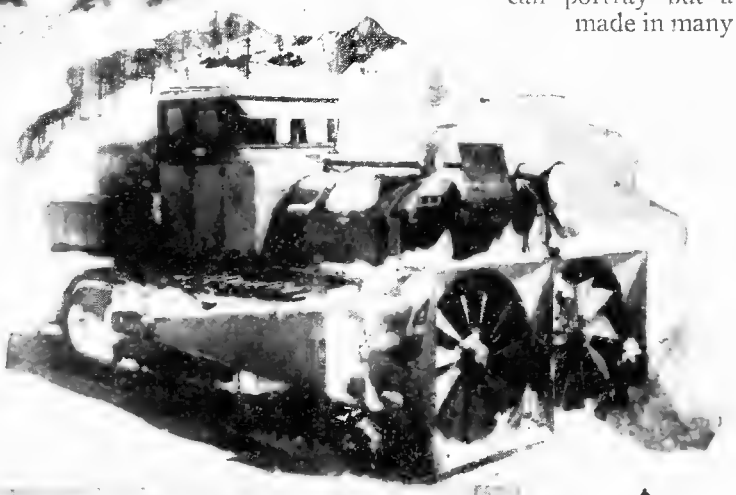
Illustration courtesy of Albany Foundry Co.

Scientific

A Photographic Picturization

It is almost impossible to keep up with
ence. This is truly a scientific age, and
directly or indirectly, will be of lasting
can portray but a
made in many

TUG-O-WAR BETWEEN AIRPLANE AND AUTO—The photo shows a 1915 Ford in an engagement with a Waco plane, powered with a 220-horsepower motor. The Ford develops but 22 horsepower. The latter machine gained an advantage over the plane in the early part of the contest, but when the Wright Whirlwind motor was opened wide, the little car was overcome. The contest took place at Chandler Field, near Atlanta, Georgia.

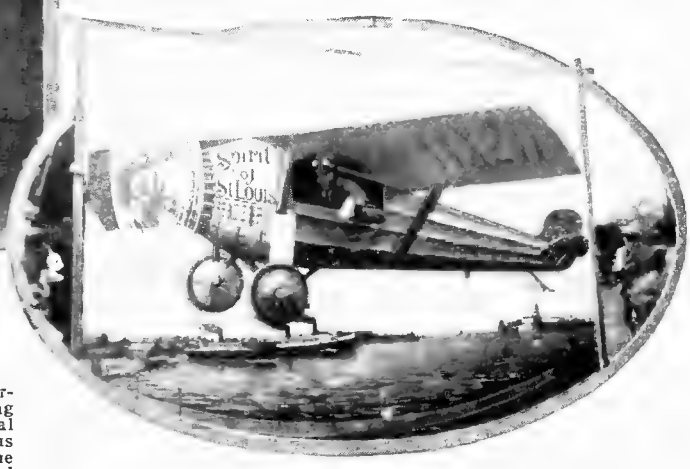


MANICURING MACHINE — Miss Mary Chandler demonstrating how the new nickel-in-the-slot manicuring device is manipulated. Two fingers are placed on the polishing surface at the same time.

SNOW PLOW—One of the hundreds of tractor snow plows employed in Switzerland to clear the roads during winter months. They are used every day during winter season.

CATERPILLAR TRACTOR BARROW—The photograph shows the application of the caterpillar tractor idea to a wheel barrow. It is the inventor's claim, and it seems to be borne out in practice, that the wheel barrow designed as the photograph indicates, is capable of being operated more easily over very rough or rocky ground. An ordinary wheel-barrow stalls in front of larger obstacles.

AUTOMATIC VENDING MACHINES—The above photograph shows the automatic merchandising devices recently placed into service in a United Cigar Store in New York City, where the customer can secure his package of cigarettes without waiting in line. Three machines make change, and then one drops the proper currency into the slot of the machine which distributes the cigarettes or cigars designated on the front of the panel.

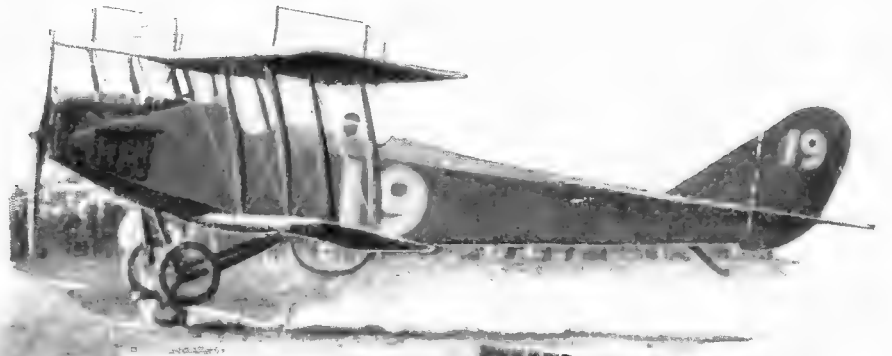


YOUR PHOTO IN LINDBERGH PLANE. The Lindbergh influence has certainly had its effect on the enterprising photographers in Mexico City. Sensing the business possibility that Lindbergh's visit to Mexico might bring, several enterprising photographers rigged up contrivances to enable anybody to pose as an aviator in the "Spirit of St. Louis." The photograph at the right shows the view of the canvas. Place your fingers over the spectators on either side and observe the effect produced by the finished photo.

Progress

of Modern Scientific Advances

the rapid strides taken in the field of sci-
the knowledge which we daily obtain,
benefit to the race. On these pages we
few of the advances
different fields.

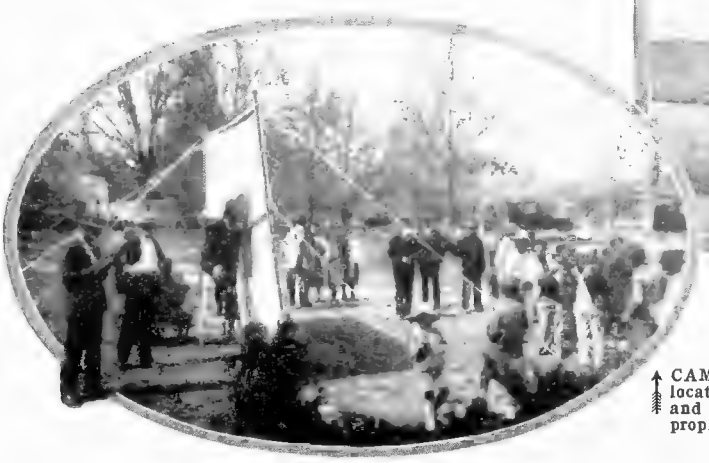


BREATH - TAKING LANDING—With her parachute tangled in the plane, Miss Jean West was dragged over the ground as the airplane taxied to a stop.

SPIRAL - VANED VESSEL. This type of construction has been used on land, on snow, and now we see it in the water, traveling at a speed of 12 miles per hour.

BANK VAULT OXYGEN TANK—It is not unusual for a teller at a bank to find himself locked up in the bank vault with little or no possibility of escape. This photograph shows the new system for supplying life-giving oxygen and was taken at the conclusion of a successful test.—W. I. Gaston.

THE SWORD OF LIGHT—Interesting photographic records of the recent eclipse of the moon were made in Berlin with ordinary equipment. The photograph above shows the unique two-blade sword of light in the heavens obtained by a continuous exposure on a photographic plate. The picturization shows how the light of the moon diminished as the shadow of the earth crept across its face and its return again to normalcy from the point of totality.



THE DAWN AND ITS LANDING GEAR—The photograph shows the ill-fated Dawn shortly before its last take-off. This was considered by airplane designers to be the last word in safety. The insert shows the way the wheels fold into the body of the plane when not in use.

CAMERA + PAINTING = AVIATOR—The photograph here shows an "on location" scene. The picture of the "Spirit of St. Louis" is painted on the canvas, and the "terra firma" aviator pokes his head up through the hole in the canvas prop. Note photographer surrounded by spectators and compare this picture with the one on opposite page.

Eliminating Fatal "Tail Spin"

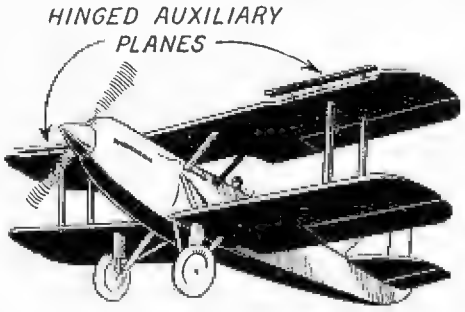
"Tail Spins" Have Accounted for the Deaths of Many Famous Aviators—New Device Eliminates Them

By C. A. OLDROYD
AERONAUTICAL ENGINEER (English Correspondent)

(Excerpt from letter written to author by Handley Page Company.)

THE object of the device is to provide complete lateral stability when stalled. The main characteristics of an aircraft when stalled, and fitted with automatic slots to the extremities of the wing, are that the center portion of the wing is stalled, but by virtue of the slot, the wing tips are not stalled, which thus provides automatic lateral stability. From the pilot's point of view, when flying in a stalled state it appears as if "sky-hooks" are attached to the wing tips; because whatever happens, the nose of the machine always drops first and never the wing tips, whereas in aircraft which are not fitted with the automatic slot, a wing invariably drops on the aircraft being stalled, and not infrequently is followed by an incipient spin, a maneuver which requires considerable height and prompt action on the part of the pilot to counteract. With our invention the INCIPIENT SPIN IS ENTIRELY ELIMINATED. *We have no hesitation, therefore, in saying that aircraft fitted with our device are 85 per cent safer than those not so fitted.*

A special feature of this device is that the maximum speed of the aircraft is in no way reduced, as at high speeds the slot is hinged back into the plane, and forms a natural leading edge.



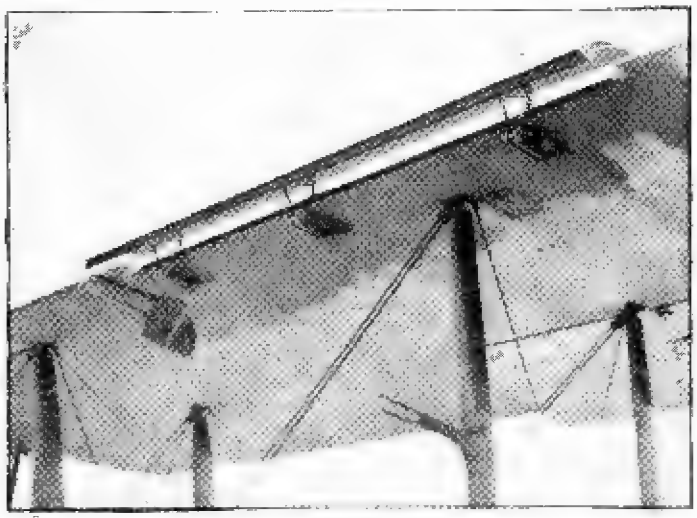
Above we have a view of a plane equipped with the new wing slots which eliminate the deadly tail spin. Fig. 7.

AVIATION is one of the world's youngest industries, and slowly but surely its many dangers and difficulties are being overcome, thanks to the ceaseless efforts on the part of aeronautical designers and research workers.

Up to the present, flying called for a great deal of skill, and for men of quick perception, capable of acting instantly in an emergency.

"How is it that flying is still such a tricky business?" the reader may ask. "We have strong airplanes, high-power engines capable of running hundreds of hours on end, and under full load, too. And yet—flying does not appear to become any safer."

The answer is this: Up to the present time, airplanes have not proved sufficiently stable for general use. If you have ever amused yourself with flying small glider models cut from stiff paper, to resemble more or less an airplane in appearance, you will recall how difficult it is to get such a model to fly straight and without "wobbling" for even a short distance.



The above photo shows a Handley Page plane equipped with an automatic wing slot, which makes a plane fitted with this device 85 per cent safer than an ordinary one.

FORCES ACTING ON PLANES

Briefly, the working principle of an airplane may be explained as follows: (Fig. 1) The rapidly rotating propeller pulls the airplane through the air; the machine is supported aloft by the air pressure on the wing surface.

The various forces acting on the wing are shown in Fig. 1. At a certain point, called the "center of pressure," the total air pressure may be assumed to be concentrated, as far as its effect is concerned.

This total air pressure, P_T, acts at right angles to the wing section. Resolving the vertical and horizontal forces, we obtain P_V, the vertical lifting forces, and the drag, P_D, the resistance the wing offers to progress through the air.

In Fig. 1, the wing is shown inclined at a certain angle to the horizontal; the greater this angle, the greater also become P_V and P_D. This family of forces is linked together, and the airplane designer must carefully adjust the various factors to get the best possible results with a given wing profile.

As we increase the angle of inclination of our airplane wing, the air pressure at a given speed does not increase continually, but only up to a certain critical point "X" (Fig. 2); at a still greater inclination, the air pressure drops suddenly.

If an airplane rears up to such an angle, there will not be sufficient "lift" to support the machine; it will be "stalled," as the pilot terms it. It loses flying speed, and tends to roll over to one side, one wing tip nearing the ground, the other pointing upwards—in other words, *the machine drifts into a spin*, which is most difficult to counteract on the part of the pilot.

SMOKE SHOWS HOW WING ACTS

Experimentally, this sudden loss of lift can be shown in the wind tunnel (Fig. 3); here a wing model is suspended at the angle under test. Smoke threads are injected at different points; these threads appear as dark lines in the photo, and with their aid we can trace the air flow and visualize its effects.

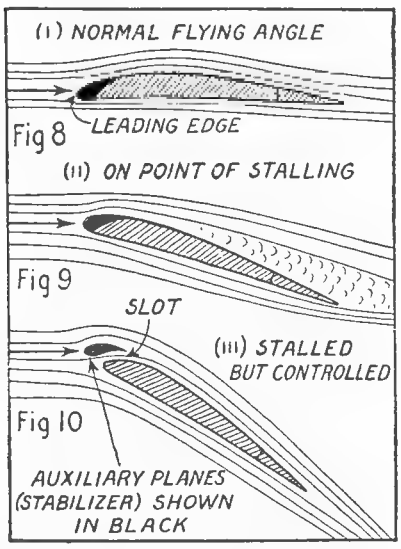
The wing section shown in photo Fig. 3 is set at a steep angle, a stalling condition. Instead of an even flow of air past the underside and upper surface of the wing, we get a very much disturbed flow. Eddies appear in the regions marked, and as they do not help to support the machine, they only waste power.

Mr. Handley Page, a well-known English airplane designer and constructor, discovered the "slotted" wing, which has a narrow slot near the front edge of the wing. Applied to the case under discussion, we see from the photo, Fig. 4, how the current of air passing through this slot re-establishes an orderly flow of air past the wing. The greater part of the eddies disappears, and the wing lifts once more in a normal fashion.

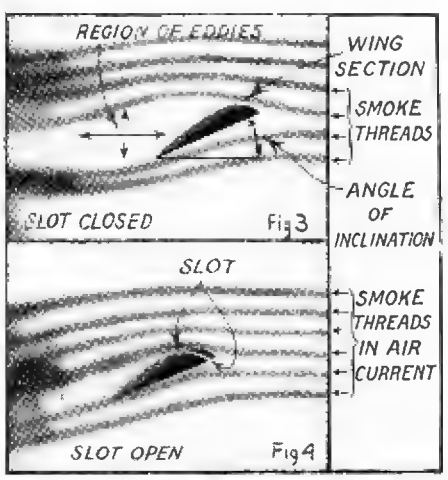
THE HANDLEY PAGE WING SLOT

For some years past, Mr. Handley Page

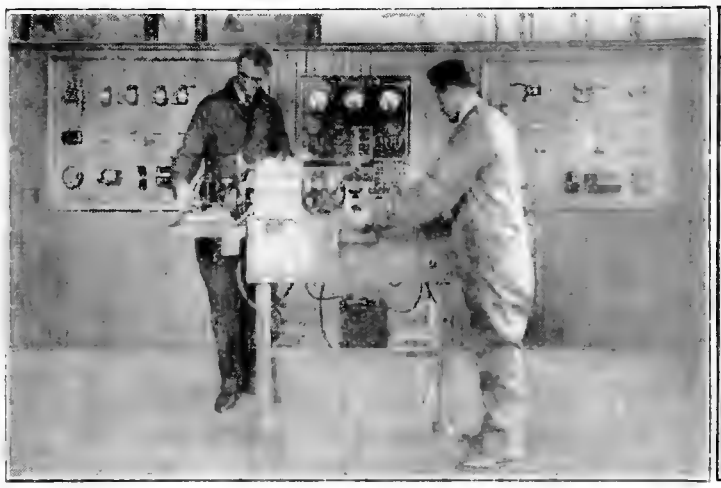
(*Continued on page* 1028)



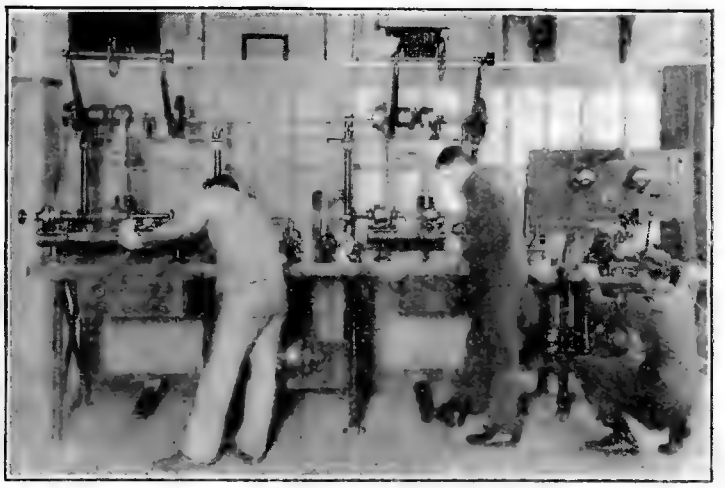
The action of the auxiliary planes or wing slots are illustrated in the above drawing.



Smoke threads, injected in a wind tunnel, provided means for studying the air flow when using the slotted wing, as shown above.



Before a generator is installed, it is thoroughly tested out on the test block. In modern automobile schools, the students learn both the mechanical and electrical features of the game. Even theory is not omitted.



Here we have a view of a group of students acquiring skill on bench lathes, and at the same time learning how to true up commutators, armatures, and how to test them electrically.

What Makes an Automotive Mechanic?

The Great Question of To-day—Auto School o r Garage Apprenticeship?—Is Here Discussed

By HENRY TOWNSEND

LAST year the number of motor vehicles registered in this country showed that over twenty-two million were in actual use; or in other words, practically every family was supplied with one of these modern vehicles of transportation, either for pleasure or business. One of the old adages in the automobile field has been that "it costs more to keep the average motor car in repair—than it does to build it." Many of us without a doubt have done some tall cussing when the monthly garage bill arrived.

As was recently pointed out by the National Automobile Chamber of Commerce, there is a veritable army of over three million people employed in the automotive industry. A great part of this vast army is employed in giving service to the motoring public through eighty-six thousand public garages spread across the country in town and city.

Some of the excessive automotive repair bills that you and I have received from time to time are, frankly, due to the fact that this great industry has grown so rapidly that a suitable number of properly trained automotive mechanics could not be supplied.

This brings to mind a very interesting problem which daily confronts the parents of our bright young men, who are about to leave school and learn a trade or profession. Shall they endeavor to place their son in a local garage, where he may serve three to four years in order to become a finished mechanic; or should they send him to an up-to-date and properly equipped automotive trade school.

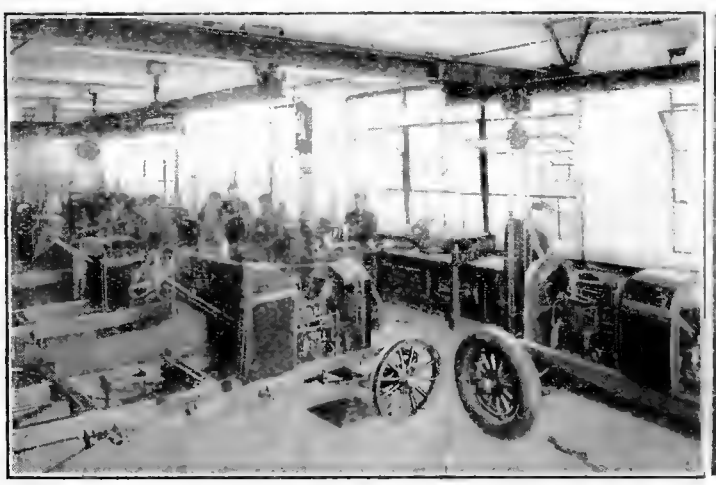
"Well, that is a very difficult question," you will answer, no doubt. What is the comparison in wages and the time required for a person to learn the automotive trade thoroughly, in the public garage as an apprentice; as compared to taking one of the combination, *practical work—theory* automotive courses in a first-class school. The answer is that considering three years as the minimum time in which an automotive mechanic can be classed as a skilled mechanic, the student taking a course at an automotive school can be taught the equivalent amount of practice, and also the very necessary theory and technical part; in the remarkably short period of three months, working six hours a day; in six months time if he only works three hours a day in the trade school.

From the writer's experience and that of many of those engaged in the automotive industry, it would seem that on the average the young man graduating as a certified student mechanic from a modern trade school, at the end of three to six months as previously outlined, can start at the same wages per week as his brother mechanic, who has spent three years and possibly much longer, working eight to nine hours a day in a public garage as an apprentice. Then think of the rapid promotions enjoyed by the ambitious graduates of the high grade trade school.

The writer wishes to stress a point or two in a purely unbiased way, with regard to the salient features of the modern automotive trade school, which teaches both practice and theory to their students, in comparison to the training received by the average apprentice in a garage, whether the latter is located in a city or small town.

It cannot be gainsaid that the average garage mechanic is frequently found woefully weak on the theory of the gasoline engine, not to mention the ignition and lighting system of automobiles. Unless the

(*Continued on page* 1026)



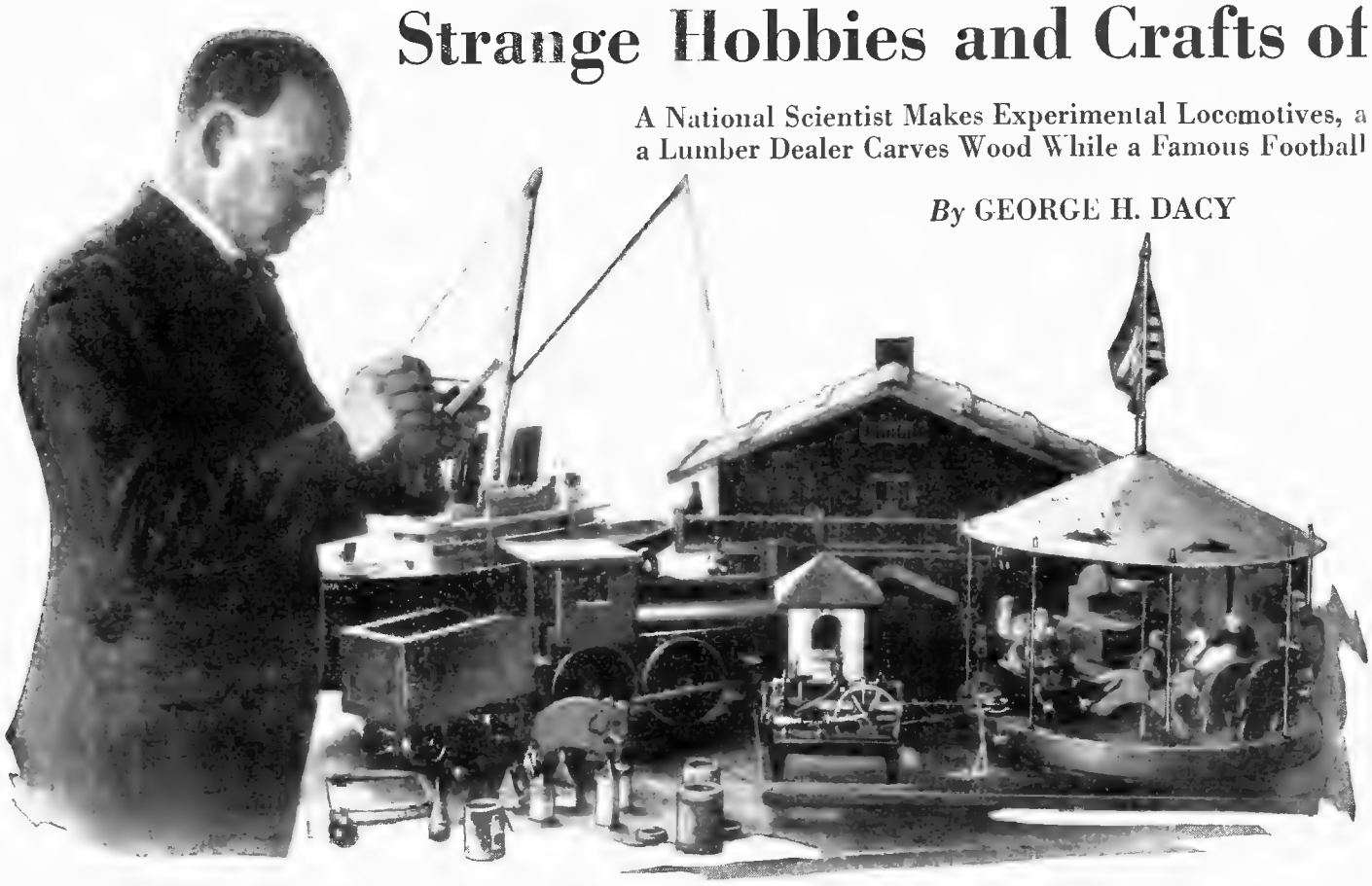
This photograph shows a few of the mechanical departments of a modern automobile trade school, where the various types of chassis are overhauled. Observe the very thorough equipment.

The proper amount of heat is very important. Overheating spoils metal, hence these students are being instructed in the proper amount of heat to use in straightening an auto frame.

Strange Hobbies and Crafts of

A National Scientist Makes Experimental Locomotives, a Lumber Dealer Carves Wood While a Famous Football

By GEORGE H. DACY



The hobbies of this college professor, L. J. Ingersoll, are indicated in the photograph above, which shows some of the toys he makes during spare hours.

"SPARE time capitalists" is an appropriate name for a group of friends of mine who devote their leisure to the pastimes of riding strange hobbies—model designing, toy making, wood carving and making golf clubs. These gentlemen have become so expert at their recreative specialties that they could earn attractive incomes from their sidelines if necessary.

Hugh Boutell, a prominent mechanical engineer, who works for Uncle Sam, spends his evenings at home where he designs and makes tiny models of railroad locomotives. These midget engines are accurate in every respect and can be operated under their own power.

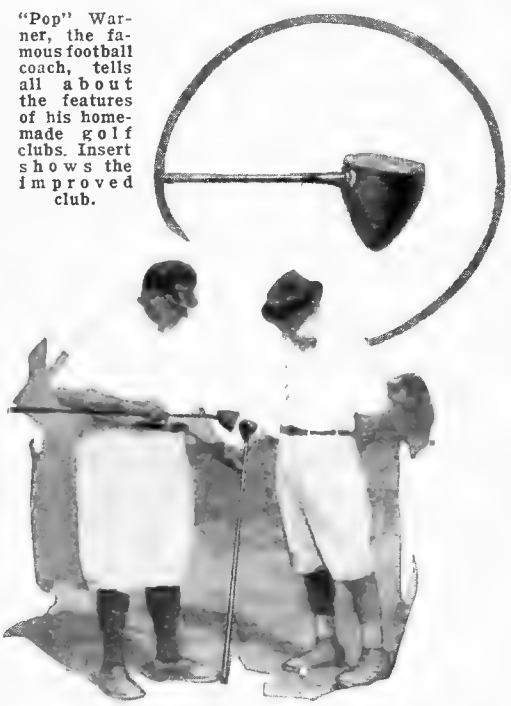
ENGINEER PLAYS WITH MODEL TRAINS

In the attic of the Boutell home in Washington, D. C., is one of the most extraordinary railroad systems in the world. The garret floor is covered with a network of railroad tracks. Diminutive locomotives haul Liliputian freight and passenger trains here, there and everywhere. A railroad junction town in miniature has even been devised as a part of this astonishing display. Clever models of railroad shops, power plants, turntables, houses, schools, stores and churches complete the industrial picture. The exhibit is one of the best and most complete of its kind ever assembled.

This engineering expert during the last seven years has made more than 40 little locomotives, all of which run and are accurate in every detail. The engines are made of tin, iron and steel. One of them runs by steam power, the steam being generated in the tiny boiler of this "Tom Thumb" locomotive. The cars are made of cardboard and plywood as are also the buildings, houses and shops.

In every aspect, the railroad track is a perfect copy of a commercial line. The brass rails rest upon wooden crossties which are anchored securely in ballast of crushed rock and cinders. There is also a third rail as most of the locomotives are run by electrical power. This rail consists of a copper wire which is soldered to wood screws.

When Mr. Boutell wishes to start one of his model trains, he turns a control switch which sets the engine in motion. It backs into a train of passenger coaches until they are all coupled together. Then the train rolls down the track, up-grade and down, until finally, it comes to a tunnel through the hills. The electric lights in the cars and the engine headlight flash up just as the train enters the tunnel. When the train leaves the tunnel at the opposite end, the lights are switched off. The rails are sanded to keep the locomotive wheels from slipping.



"Pop" Warner, the famous football coach, tells all about the features of his home-made golf clubs. Insert shows the improved club.

The above type of locomotive runs by means of tiny electric motors concealed in the tenders. Mr. Boutell has harnessed the same electrical current which illuminates his home to also run the locomotives and rolling stock. The turntable is operated by thread controls. A ferry boat which links into the railroad system is also run by thread controls. The boat is provided with electric lights which burn brightly while the passenger craft is in motion.

The accompanying pictures will give a better idea, than a description can, of what the railroading exhibit in the Boutell attic looks like. You will notice that the system seems to be located in a region of hills and valleys. This effect is secured by small canvas scenes which the scientist has painted and placed along the borders of the track. The scenes dovetail together and form a picture of a rolling landscape.

Mr. Boutell is greatly interested in the history of American railroading. On his curious attic system, he has tested out home-made cars and locomotives similar to the commercial equipment in use at different periods during the development of the United States. The railroading exhibit although a pastime hobby has enabled him to gain familiarity with all the difficult problems of American railroading during the different stages of growth. Mr. Boutell has devoted all his spare time for seven years to this unusual recreation. He told me that it took more than six months of his idle hours to put together the railroad village and system which you see in the illustrations.

PROFESSOR MAKES TOYS AS A HOBBY

L. J. Ingersoll, a professor at one of the leading state universities of the Middle West makes toys as a hobby, in fact, he dedicates the week before Christmas to the novel occupation of making playthings for his four children. The collection of toys which

Successful Men

College Professor Plays Toymaker, Coach Makes Golf Clubs

this professor has made during the last eight years is better than any which Santa Claus ever distributed. Many of these valuable playthings took several weeks of painstaking and skilful work. Professor Ingersoll usually devotes his idle hours throughout the entire year to his extraordinary pastime. The week before Yuletide season, he completes and perfects all his homespun carpentry.

The Ingersoll toys are made from white pine, yellow pine, oak, poplar and cedar. First of all the professor draws accurate designs and plans of the toys which he purposes to manufacture for that particular season. His designs are always original.

Mr. Boutell, a prominent mechanical engineer, makes use of his spare time by designing and building midget locomotives that run. Photo shows a few of his forty models.

He aims to make toys such as are never found in commercial shops and stores. He makes the playthings strong and durable. Some of them have been used for four or five years by a quartet of robust, romping children and they are still serviceable.

In the attic of Mr. Boutell's home, we find every mechanical appliance used in modern railroading. Highway gates are raised and lowered automatically, signals operate, and the trains move around the tracks as if controlled by individual operators.

A merry-go-round is one of the finest of the Ingersoll mechanical toys. It is worth at least $150 and is probably the finest specimen of it kind ever produced in America. The amateur toy-maker remodelled a small engine so that it furnishes power to operate the merry-go-round which works on a bicycle gear. The arrangement is such that the horses, cars and seats on the apparatus rock to and fro and whirl about as the main platform turns. A toy piano plays as the device rotates, being actuated by the uniform motion of the merry-go-round. It required more than 200 hours of work for the professor to build this mechanical toy.

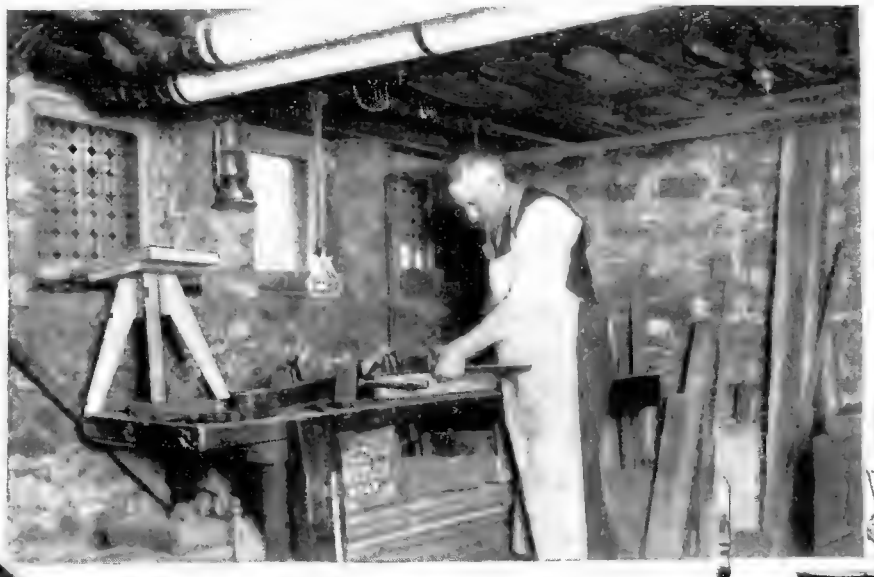
An accurate model of an ocean liner is another masterpiece in the Ingersoll collection. It has been made to scale and is a perfect facsimile of one of the mammoth salt sea greyhounds. A sailboat on the model of one of America's cup defenders is another remarkable nautical toy. A locomotive, tender, and three cars made of wood compose an almost indestructible railroad train, which has withstood five years of trying service. A toy house modelled after a Swiss chalet is another wonderful example of amateur carpentry skill. The front of the house is removable. The interior is divided into rooms, all of which are completely furnished and lighted by a tiny electric plant. The sitting room is even equipped with a cuckoo clock which works automatically. A set of building blocks made of cedar of Lebanon is another outstanding feature of the homemade toys. These blocks are twice as long as they are thick and twice as long as they are wide. They can be used as geometrical blocks in all sorts of construction work by the juvenile builders. Altogether, the Ingersoll toys are worth more than $1500 and represent the spare time industry of a fond father.

WOOD CARVING, A SPARE-TIME JOY

L. J. Scheve is a prominent St. Louis lumber dealer who by home practice, during his leisure time, has developed into one of America's most expert wood carvers. Fifteen years ago, being interested in amateur woodworking, Mr. Scheve built a large work bench in his basement and began to master

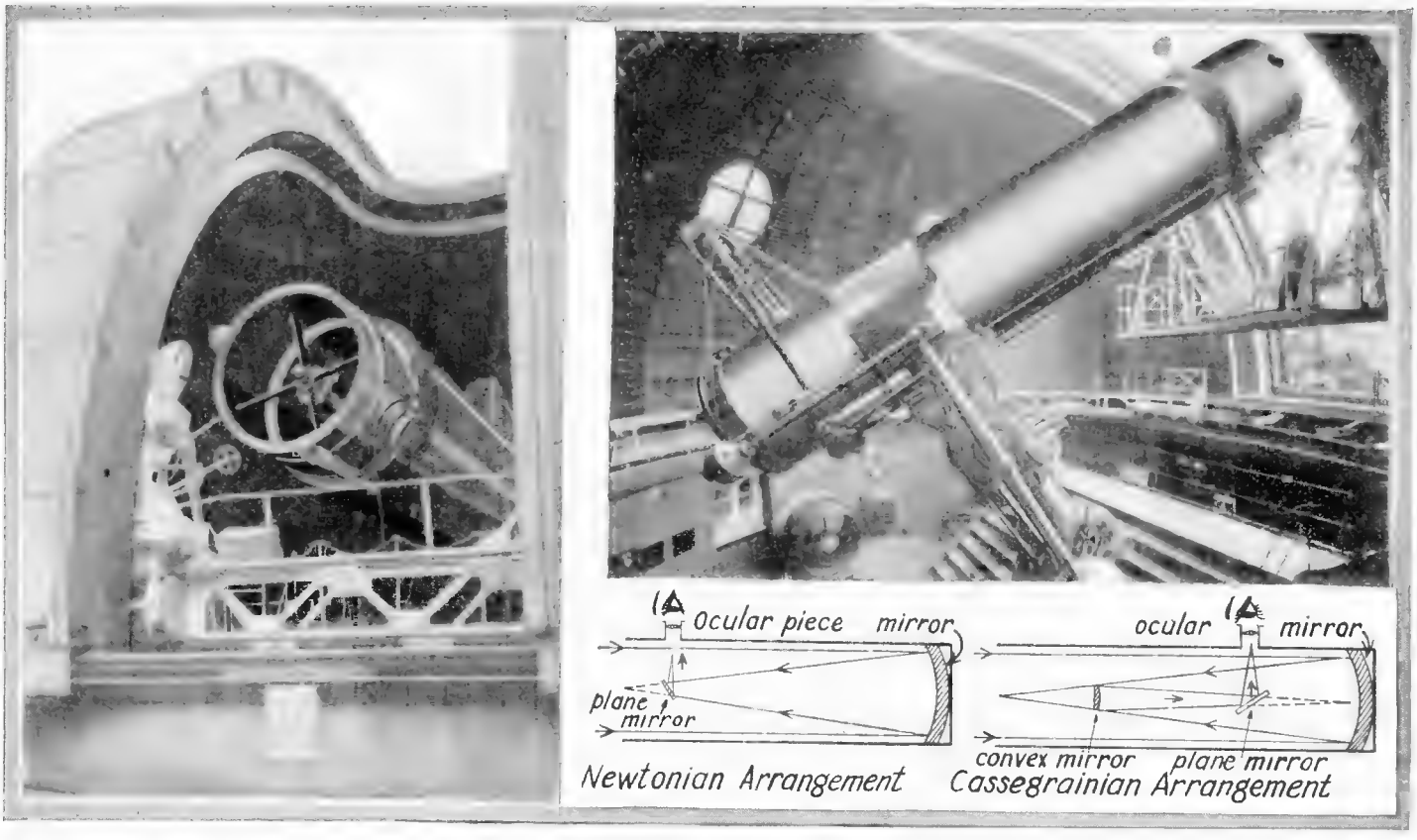
(*Continued on page* 1029)

What is more natural than to have a prominent lumber dealer use his own lumber when building things. The photographs here show Mr. Scheve at his work-bench, where he spends many hours carving. And below a hand-carved tabouret he has built.



Here are but a few of the samples of work done by Mr. Scheve in the basement shop in his home. His tabouret, shown at the left, is worth approximately $150.00—not so bad for an amateur wood-carver.

Largest Reflecting Telescope in Europe



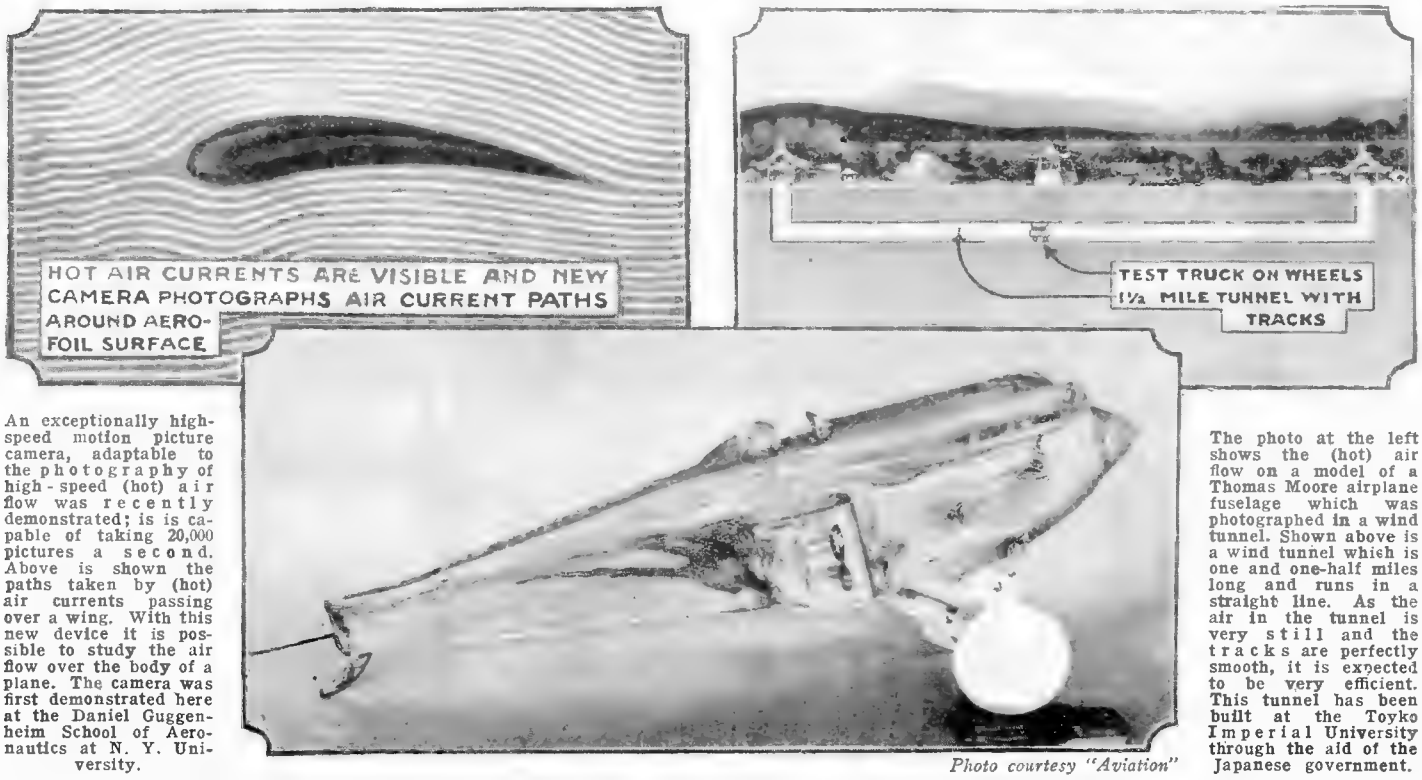
Above, the upper end of the fifty-inch reflector.

The Newtonian and Cassegrainian arrangements are compared above.

The telescope and observing platform are shown in the photo.

THE recently erected reflector at the observatory in Neubabelsberg, in Germany, is the largest of its kind in Europe. The diameter of the large concave mirror is fifty inches, the focal length 27.5 feet. The mirror is mounted on a system of cushion levers and side levers, the object of which is to preserve the shape of the mirror in different positions of the tube. After the erection of the reflector was completed, the observing platform for the Newtonian focus was adjusted. This platform is carried on rails mounted in the revolving portion of the dome. The observing carriage moves on rails on the platform. A system of gears controls the movements of the observing carriage by motor or by hand.—*Hubert Slouka.*

Air Currents Now Photographed


HOT AIR CURRENTS ARE VISIBLE AND NEW CAMERA PHOTOGRAPHS AIR CURRENT PATHS AROUND AERO-FOIL SURFACE
TEST TRUCK ON WHEELS
1½ MILE TUNNEL WITH TRACKS

An exceptionally high-speed motion picture camera, adaptable to the photography of high-speed (hot) air flow was recently demonstrated; is is capable of taking 20,000 pictures a second. Above is shown the paths taken by (hot) air currents passing over a wing. With this new device it is possible to study the air flow over the body of a plane. The camera was first demonstrated here at the Daniel Guggenheim School of Aeronautics at N. Y. University.

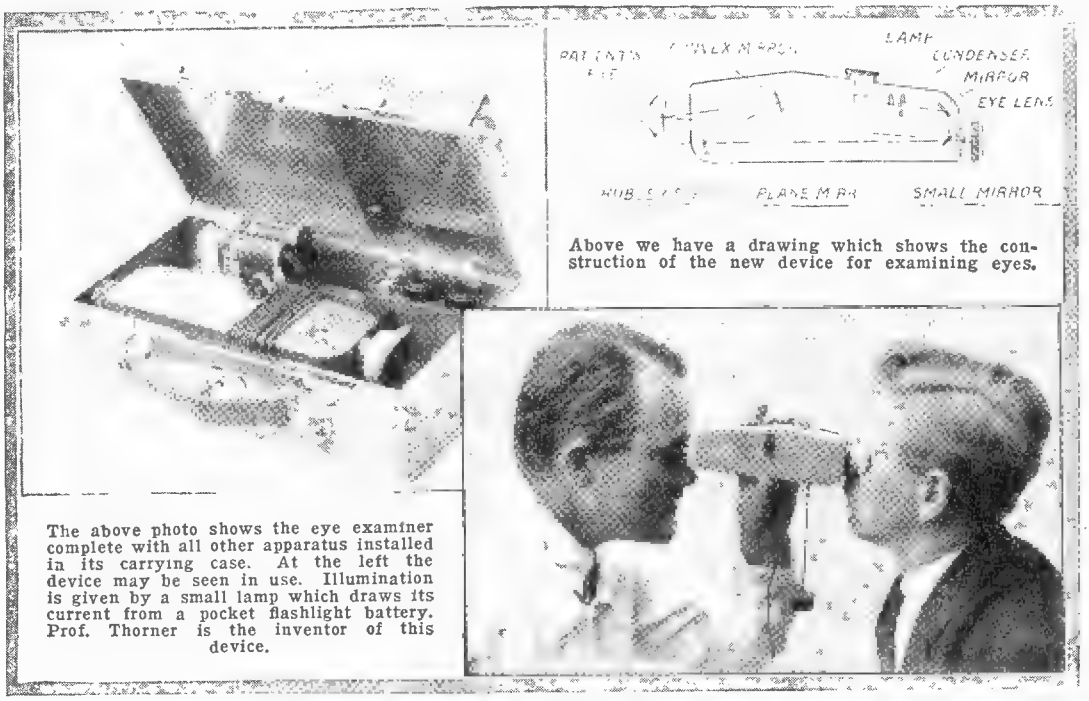
Photo courtesy "Aviation"

The photo at the left shows the (hot) air flow on a model of a Thomas Moore airplane fuselage which was photographed in a wind tunnel. Shown above is a wind tunnel which is one and one-half miles long and runs in a straight line. As the air in the tunnel is very still and the tracks are perfectly smooth, it is expected to be very efficient. This tunnel has been built at the Toyko Imperial University through the aid of the Japanese government.

New Apparatus for Retinal Examination

THE old apparatus which was used for eye examination was found to give incorrect results due to the reflected light from the cornea of the eye. Recently, Prof. Thorner of Germany succeeded in constructing a reflecting instrument which avoids this trouble, whether due to the reflection by the cornea or to the lens of the instrument. In the new appliance there is no lens. In its place there are mirrors which illuminate the retina of the eye. These mirrors carry the image to the eye of the observer. Hitherto the light for illuminating the retina went through the entire area of the pupil of the eye; in the new instrument it only goes through one-half. One-half is screened so that no disturbance due to light can occur. The observer looks through the unilluminated half of the pupil into the interior of the eye under examination and sees the retina. The diagram shows how this is done. The beam of light emitted by the lamp, goes through the condenser, and after reflection on the mirror, gives an image of the source of light on a second smaller mirror which is exactly on the line of the screened portion. The rays then go from the square plane mirror, to a convex mirror, and thence to one-half of the pupil of the patient's eye and light up the retina. The rays reflected

(*Continued on page* 1029)

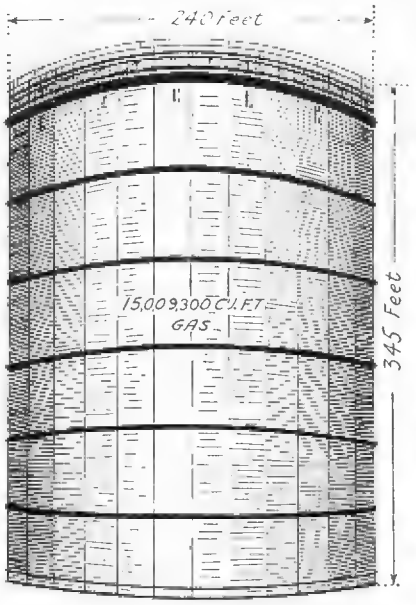


Above we have a drawing which shows the construction of the new device for examining eyes.

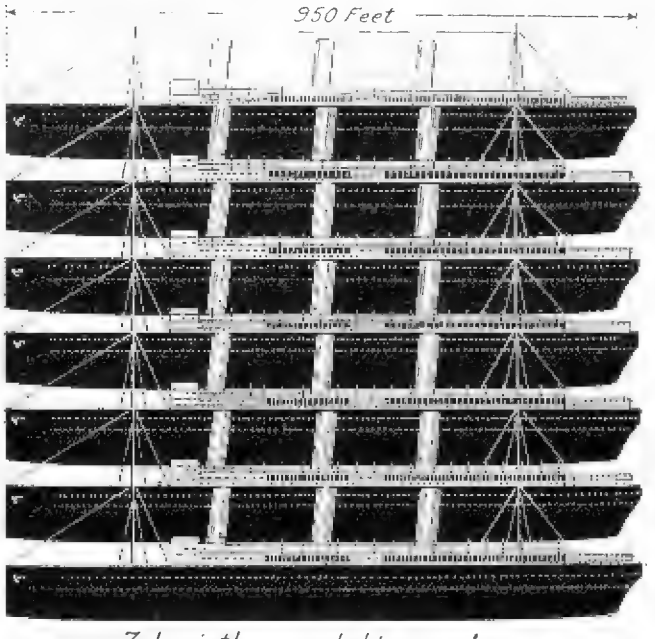
The above photo shows the eye examiner complete with all other apparatus installed in its carrying case. At the left the device may be seen in use. Illumination is given by a small lamp which draws its current from a pocket flashlight battery. Prof. Thorner is the inventor of this device.

World's Largest Gas Tank

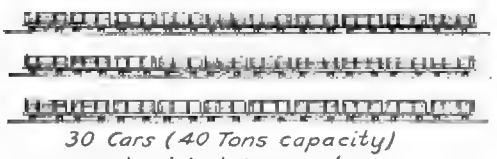
Statue of Liberty



Gas Tank at Harrison New Jersey



7 Leviathans needed to equal Gas Tank capacity



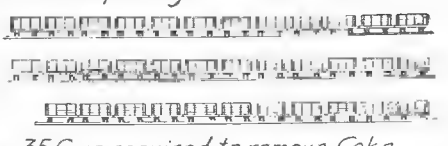
30 Cars (40 Tons capacity) required to bring coal

1200 Tons of Coal

72 Tons of Tar

702 Cu Ft Liquid Ammonia

700 Tons of Coke



35 Cars required to remove Coke

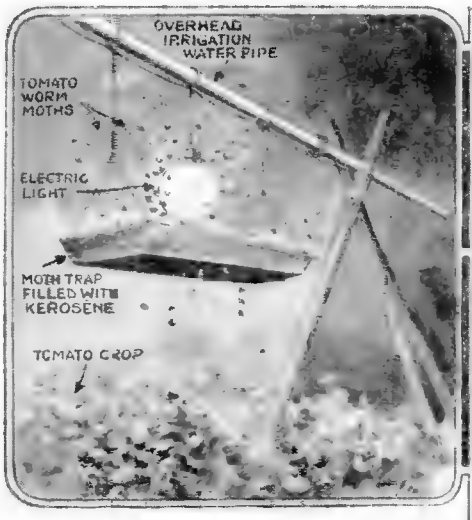
The largest gas tank in the world has been constructed at Harrison, New Jersey by the Public Service Electric and Gas Co. This huge tank is capable of containing 15,009,300 cubic feet of gas. The tank itself is 345 feet high and 240 feet in diameter, and is 40 feet higher than the Statue of Liberty. Seven Leviathans each 950 feet long would be required to equal the gas tank capacity. In order to fill this tank to its capacity, it would necessitate the burning of 1,200 tons of coal.

Thirty freight cars of 40 tons capacity each would be required to bring the coal used for making enough gas to fill the tank. Thirty-five cars of the same carrying capacity would be required to move the 700 tons of coke which would be obtained as a by-product, after burning the coal. Further by-products of the combustion of the 1,200 tons of coal would be 72 tons of tar, and 702 cubic feet of liquid ammonia, besides the 700 tons of coke mentioned above.

Courtesy of Technik Für Alle.

The Month's Scientific News Illustrated

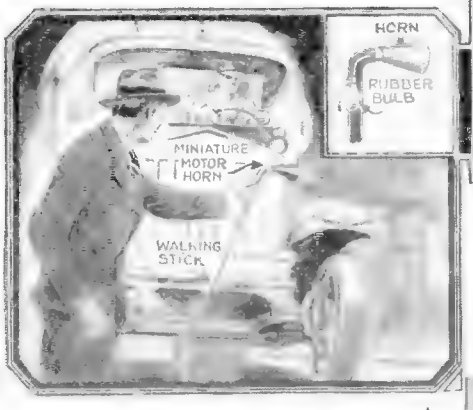
By GEORGE WALL



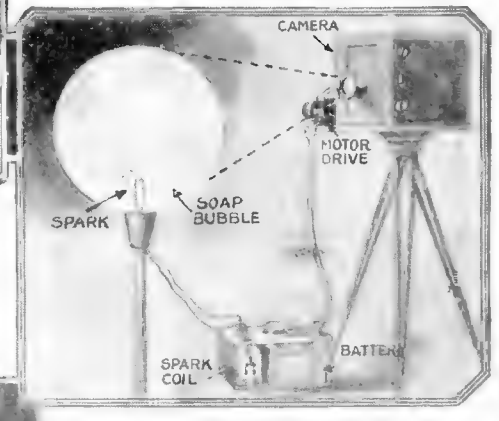
On a truck farm in Virginia, irrigation is carried out by means of overhead pipes. A large part of the farm is wired for electric lights, which are used to combat tomato worm moths. The moth traps are placed about ten feet above the ground and six inches under the electric light, attached to the pipes.

Corp. Richard L. Huffman of the Marine Corps inflated a collapsible rubber raft while falling 3,000 feet from an airplane to the Potomac River. When the raft was inflated he dropped it, released himself from his parachute when reaching the water and climbed aboard, rowing to safety.

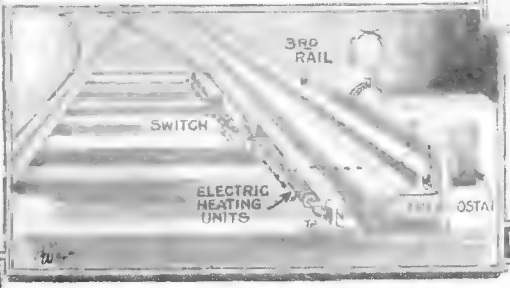
Mr. A. O. H. Perry, of Hasbrouck Heights, N. J., recently released a toy balloon with a card attached to it which bore his name and address. This balloon travelled to Maracaibo, Venezuela, where it was picked up by Antonio Quintero, who immediately notified Mr. Perry.



Asserting his right to cross the street in safety, a pedestrian appeared in Southampton, England, with a miniature but noisy motor horn attached to his walking stick. He sounded warning blasts to automobilists when he was about to cross the street.



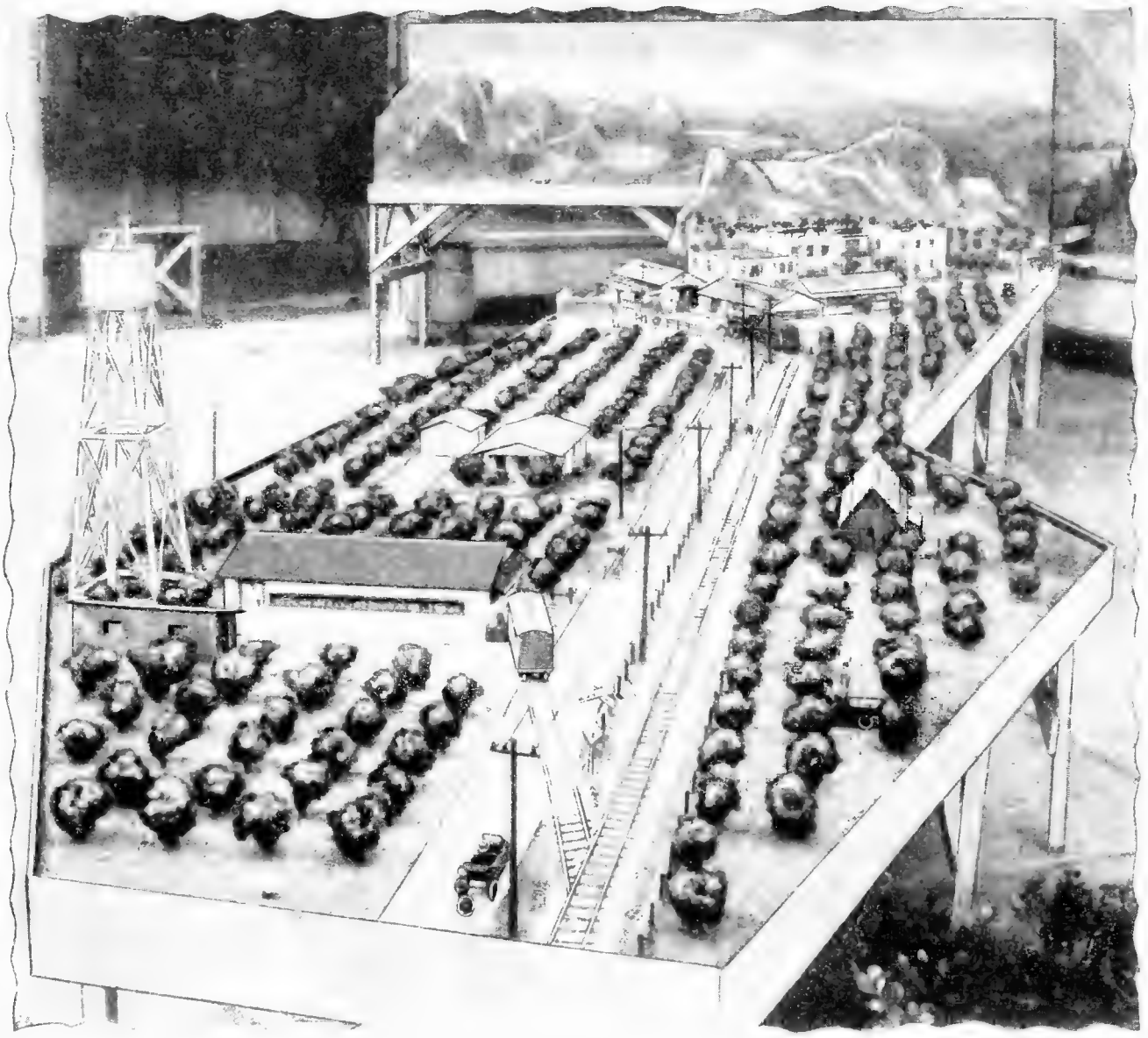
Explosions are symmetrical and are not an erratic splash of fire as they seem to be. Tests made at the National Bureau of Standards with soap bubbles filled with explosive gases and fired by a spark, permitted extraordinary photographic records to be made of "blasts."



The Interborough Rapid Transit system of New York City keeps track switches clear of ice and snow with a unique system of electric snow melters. The heating unit is placed under the track switch and is connected to the third rail. About twelve heating units are applied to each switch. The thermostat turns on the current automatically whenever the temperature falls very low.

In Kansas City there has been built a house said to be tornado-proof. A storm-proof bedroom has been built in the basement, the concrete walls and ceiling are eight inches thick, reinforced with iron bars. A ten-foot passage leads to a "tornado cellar." The owner intends to take pick and shovel with him, so that he can dig his way to the surface.

The majestic white baton of the Parisian traffic gendarme will now be replaced by one having electric lights. A French inventor has devised an illuminated baton which was tested and found practical by the police. This baton has two electric lights in a notch at the top; one light is red and the other white. Electric wires run through the center of the club to a small battery strapped on the officers' belt. The club is the invention of M. Legonas.



Above we see one of the completed model farms which has been built to exact scale. Notice the exactness and detail obtained.

Miniature Cities---How Built

By LEE BLACK
The Man Who Builds Them

Increasing Demand for Realism in Replicas for Exhibitional Display—How to Build and Sell Them

Above-Moulding a mountain out of clay.

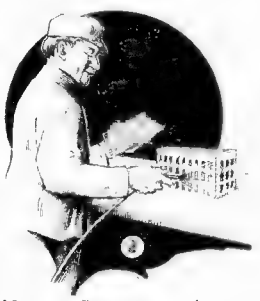
AN insistent demand for the miniature modeller's art is rapidly invading all crafts which involve an intelligent form of industry. This fascinating knowledge and application of all of the graphic arts, was once confined almost entirely to the problems of architectural and engineering development.

The scale model, as it is known to architects, engineers, shipbuilders and scientists, is of necessity a thing of machined precision rather than ethical beauty of line and composition; and the latter enters the equation only when all of the requisites of the former have been faithfully executed.

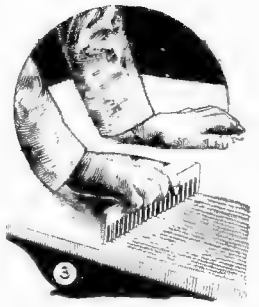
The advance of the scale model into the realms of business has been subtle but steady. Sweeping changes which have revolutionized advertising art over the past decade are back of the newly-awakened interest in replica-craft.

The art may be classified roughly into two general divisions—utility and exploitation. In the former the model serves the purposes of technical observation, research and experiment; in the latter advertising, idealization, and attention-compelling composition.

The art and color printing presenting pictorial subjects in flat values no longer satisfy the business man who demands more and more realism in telling his story to the consumer-public; and it will have been observed by the reader that the so-called "cut-out" revealing depth and perspective, and creating more or less, the illusion of dimensional values, is rapidly supplanting the conventional poster.



Above — Spraying paint on the houses.



Using comb to make furrows.

The miniature model is the outgrowth of this trend in the direction of realistic advertising and ultra-precision in the fields of utility and business.

In either case its mission is to convey a truthful and accurate story of an existent achievement or of a proposed ideal. And as such it expresses a satisfying fidelity which most certainly cannot be surpassed by any other known medium. Its use by moving picture producers is well known and to the movies can be ascribed much of its present development.

PRICES PAID FOR MODELS

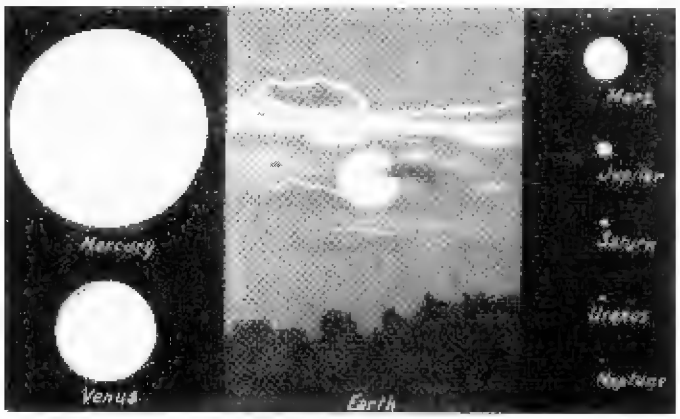
The prices paid for good models range

(*Continued on page* 1030)

Visiting Other Planets

French Scientist Presents Picture of Scenery on Other Planets Than Ours

By JAMES NEVIN MILLER



At the left we have a conception of the variation in the apparent size of the sun as seen from the various planets of the solar system. The sun, as it appears to the inhabitants of the earth, is shown in the center. The sun appears largest from Mercury and the smallest on the planet Neptune.

IF human beings could voyage throughout the great solar system what kind of scenery would they discover? Transplanted in the twinkling of an eye to the various neighboring worlds, the moon and the other mysterious planets, what wondrous and strange things might they find?

These imagination-holding considerations are discussed by the celebrated French astronomer, Lucien Rudaux, in a report to the Smithsonian Institution, even more interesting than the seemingly fantastic extravaganzas of Jules Verne.

Refusing to regard his picture as mere phantasy, Professor Rudaux declares that within certain limits he can reply positively to some of the absorbing questions which are asked continually concerning growths and geological formations in the heavenly bodies. Modern science he says, has precise data which makes possible a visualization of the general conditions on the celestial worlds.

THE MOON'S LANDSCAPE

Were an explorer to travel in the land of the moon, 239,000 miles away, his wondering eye would find high, steep mountains, not unlike our own; huge gray plains, entirely devoid of life, divided now and again by gigantic fissures whose proportions have no parallel on earth.

The great science of geometry enables astronomers to put easily into actual prospective all the details which the telescope allows them to see in relief under an oblique illumination. So sharply are the shadows delineated that they may be seen to elongate, as the sun rises or sets for different regions of the lunar surface. This fact, Mr. Rudaux explains, enables man to calculate exactly the heights of the various parts of this surface.

As for the lunar mountains, the great majority are of such gigantic size that the traveller would be unable to see their whole extent at a single glance. "It would be necessary to turn around in order to see their circular walls which would appear like a long chain of more or less irregular formations. For some of them, were an earthly visitor at their center, their ramparts would be so far distant as to be invisible, far below our horizon."

"We must further remember that on the moon, because of the greater curvature of its globe, relative to the stature of man, the horizon is closer, and therefore objects disappear behind it at a shorter range." Consequently the visitor could see from one place, only those craters which are very small and numerous and whose diameters are of the order of a kilometer."

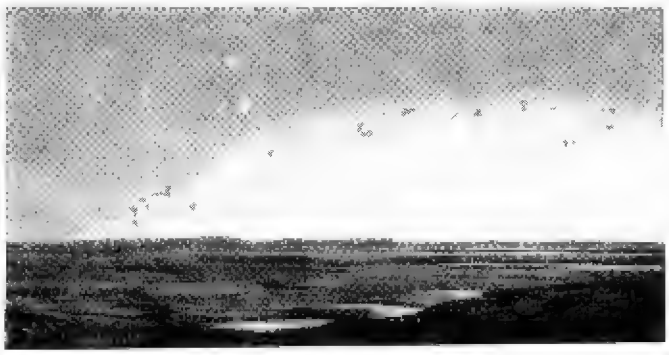
Even stranger to the human eye than the grotesque contours of the moon would be the atmospheric conditions. In fact, Mr. Rudaux points out, the moon has no atmosphere at all, or at least none that science can detect. Consequently, since there is no air to scatter the light coming from the sun, there is an eternal black sky, dotted with stars something like the condition on earth at night.

In this peculiar lunar day-time the stars do not twinkle. Yet a human voyager could see every detail of the landscape, near and far as his eye could reach, with the same dry and constant sharpness. Because of the lack of air there would not be the slightest softening of the view; a remarkable contrast to the condition on earth, where the different distances merge harmoniously in blending vapors. Here our atmosphere presents a serious obstacle to really good contemplation of the heavens, for it obstructs greatly the light coming from the stars, troubles their images and even limits their visibility. In a sense it is a real veil placed before our eyes—a veil which is nonexistent on the moon where the heavens shine in striking majesty.

WONDERFUL VIEW OF HEAVENS FROM MOON

Fortunate indeed, therefore, would be the lot of the astronomer-visitor to the moon. The wonderful richness of the picture would provide a facility for observation without parallel here on earth. Color schemes would put to shame our most magnificent offerings, so unique and striking would they be. The familiar beauties connected with the rising and setting of the sun would be unknown, but in their place would be a color mixture undoubtedly superior. At sunrise might be viewed above the horizon the radiant glory of the sun's corona, and in its wake a series of gigantic rose-colored flames. Far up in the sky a great disk of light would be seen, 13 times larger than the moon appears from earth. This is the earth itself, which is the moon's moon. It appears to be at rest, though it is not actually so, for reasons connected with the unequal movement of the moon in its own eccentric orbit. Technically speaking, the terrestrial globe, the earth, appears to oscillate about a mean position—or in other words a position whose movement is not readily discernible to the eye.

Sunrise upon the moon, seen from a place situated at the equator. The central regions are illuminated by the earth situated in the zenith. The imaginary traveler would view an unfathomable space riddled with stars which never twinkle.



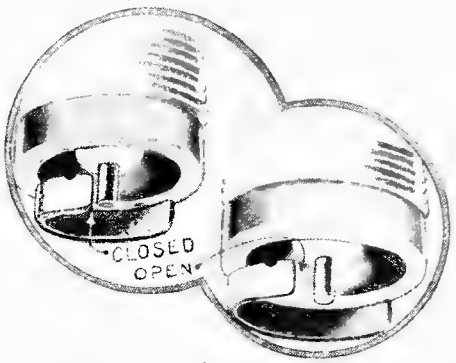
The landscape on the planet Mars as visualized in the dusk of the evening, appears at the right. The bleak, level landscape consists mostly of immense swamps. Note the stars twinkling in a splendor enhanced by the two small moons.

EARTH'S PHASES VISIBLE ON MOON

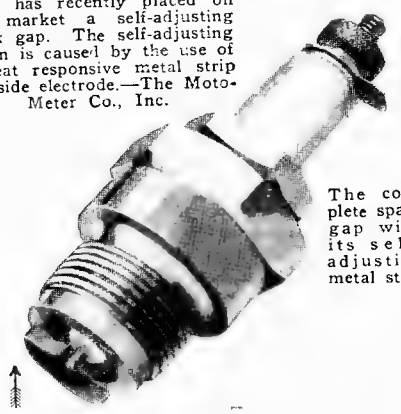
Back of the earth, as viewed from the moon, the sun and the stars would appear to be filing slowly, whereas actually the earth is rotating upon its own axis and changing phase, like our moon, with the varying position of the sun, from which it receives its light. The position in the sky where the earth will seem to be, changes with the position of the observer. However, when the earth *is* "full" it will shine with intense brilliancy.

(*Continued on page* 1032)

Self-adjusting Spark Gap



An automobile supply company has recently placed on the market a self-adjusting spark gap. The self-adjusting action is caused by the use of a heat responsive metal strip as a side electrode.—The Moto-Meter Co., Inc.



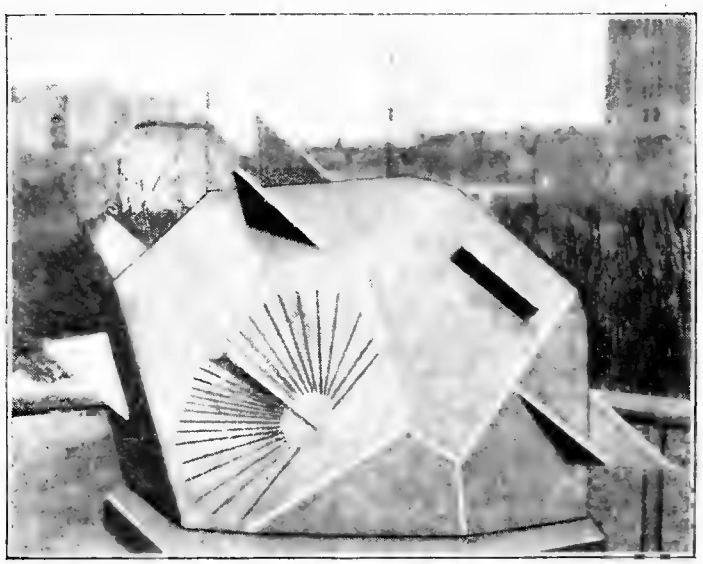
The complete spark gap with its self-adjusting metal strip

FOR years it has been the dream of automotive engineers to produce a spark plug embracing the principle of the variable gap. It has been long known that a short gap was best for starting and a wide gap for running. Up to the present, spark gaps have been set at a mean average and consequently the gap has been too wide for easy starting and too short for proper running. The new spark plug is arranged so that a gap of fifteen-thousands of an inch is provided when the engine is cold and thirty-thousandths as soon as the engine has started. The adjustable electrode is composed of a bi-metal strip, which is highly responsive to heat.

An Unusual Sun Dial

THIS sun dial, besides giving the time for the place in which it is located, also gives the time in many other places in all parts of the world. The model shown is located at Baltimore, Md., and has been giving the correct time since 1892. As shown in the photograph, the dial has many faces, each giving the time at a certain place. Among the numerous points which are accounted for by this clock are: Cape Cod, Cape Town, Jerusalem, Calcutta, London, Honolulu, San Francisco, Sitka, Pitcairns, Polar Regions, etc. The vanes casting the shadows on the various faces can be plainly seen and the hour calibrations for the one in the foreground are easily noted.

⟹



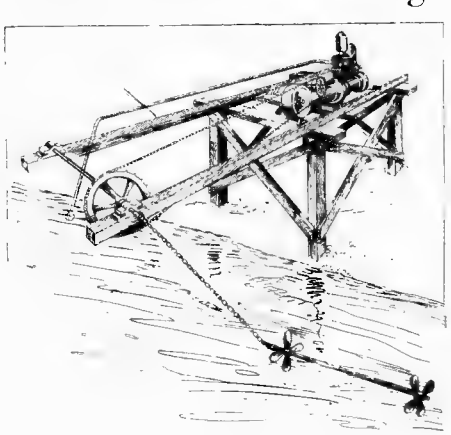
The sun dial with its many faces giving the time all over the world can be seen above. It certainly is a unique model.

Chemical Spray to Catch Wild Animals

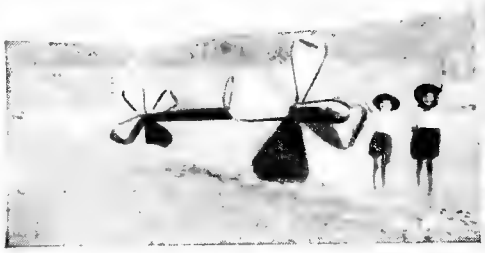
Dr. William Beebe, the well-known explorer will use this system to catch many of his specimens

WHEN William Beebe, naturalist and man of letters, explores the jungle floor of Haiti this winter, he will adapt to scientific ends an idea gained while watching a caretaker spray the grass on a golf course. With the same chemicals that brought a host of earth worms to the surface of the links, Dr. Beebe plans to ferret out a small army of tropical underground animals. Dr. Beebe declared that he wished to expose the idea that most persons had, that it was an exceedingly difficult matter to observe and collect wild life. He has recently used several other very ingenious methods of collecting animals that would surprise most people.

Irrigation Aid, Seen in New Water Pump



The complete pump is shown here.



The propeller arrangement used to obtain the power can be seen here on the beach.

This illustration shows the complete installation operating in a swiftly moving stream.

AN ingenious arrangement has recently been perfected to irrigate the land surrounding a stream. It is in the form of a double propeller fastened by a chain to a gear and pump which draws the water from the stream into the irrigation ditches. By using this method it is possible to irrigate a large section of the surrounding country without the expenditure of any fuel. This device promises to be of great importance in the near future.

The Metal EMPEROR

by A. Merritt

Author of "THE MOON POOL", "THE FACE IN THE ABYSS" etc.

INTO THE PIT. (Sixth Installment)

Synopsis

Dr. Louis Thornton is traveling through Tibet with his Chinese servant-cook, Chiu Ming, and two ponies that carried the impedimenta. They come upon a white man who introduces himself as Richard Keene Drake. Drake's father had been very friendly with Thornton. The three decide to carry on and come upon Martin Ventnor, a geologist, and Ruth, his daughter. The latter are guarding themselves against hundreds of soldiers who belong to an age at least twenty centuries back. While escaping they are attacked and would have been exterminated, were it not for the timely intervention of Norhala, a tall, beautiful, metallic-haired woman, whose control over lightning and over heavy metallic blocks was phenomenal. These blocks, at her command, would make a bridge for her to walk on or form themselves into battling monsters to protect her or obey her every whim. Chiu Ming is killed in the battle, the survivors leaving with Norhala. Ruth and Norhala get on one of the blocks. The others stand upon a second composed of four smaller ones joined together by their own peculiar super-normal power. The platforms speed through space at a terrific rate, arriving eventually in the court of the Metal Emperor. Angered by the influence of Norhala over Ruth, Ventnor raises his rifle and fires at the red ruby-like object he believes to be the brain of the metal monster. He is struck down by a lance of green flame and rendered unconscious. The metal monster gives Norhala the entire company to serve as her toys. She takes them to her home, where she informs Yuruk, her ape-like eunuch attendant, they are not to be harmed. Ventnor talks, then lapses into unconsciousness again. Ruth, after telling about the strange power that holds her enslaved, goes to sleep. Drake and Thornton discourse on the metal intelligences, and come to the conclusion that they are guided by some sort of group consciousness, and that they move by super-rapid molecular "steps!" Yuruk, because of jealousy, informs Drake of the way back to the city, which Ventnor, in a semi-conscious state, told them was their only hope. Yuruk claims that though the inhabitants of the city were hostile, it is much safer to escape.

CHAPTER XVIII

THE sun was high when I awakened, or so I supposed, opening my eyes upon a flood of clear daylight. As I lay, lazily, recollection rushed upon me. It was no sky into which I was gazing; it was the dome of Norhala's elfin home. And Drake had not aroused me. Why? And how long had I slept?

I jumped to my feet and stared about. Ruth nor Drake, nor the black eunuch, was there.

"Ruth!" I shouted. "Drake!"

There was no answer. I ran to the doorway. Peering up into the white vault of the heavens I set the time of day as close to nine; I had slept then five hours, more or less.

I heard Ruth laugh. Some hundred yards to the left, half hidden by a screen of flowering shrubs, I saw a small meadow. Within it, a half dozen little white goats nuzzled around her and Drake. She was milking one of them.

Reassured, I drew back into the chamber and knelt over Ventnor. His condition was unchanged. My gaze fell upon the pool that had been Norhala's bath. Longingly I looked at it, then satisfying myself that the milking process was not finished, I stripped and splashed about. I had just time to get back in my clothing when through the doorway came the pair, each carrying a porcelain pannikin full of milk.

"Oh, Louis," cried Ruth. "You should see the goats! The cutest little silky white things—and so tame. There's nothing the matter with this milk, I can tell you—and that awful black thing isn't around to poison it with his eyes. Ugh-h!" she shuddered.

There was no shadow of fear or horror on her face. It was the old Ruth who stood before me, nor was there effort in the smile she gave me. She had been washed clean in the waters of sleep.

"Don't worry, Louis," she said. "I know what you're thinking. But I'm—me again. It was all quite true. But I'm going to stay—me. And don't you worry."

"Where is Yuruk?" I turned to Drake, and at his wink and warning grimace forebore to press the button.

"You men pick out the things and I'll get breakfast ready," said Ruth. "Oh!" She was looking down into the pool. "Somebody's been in it. We'll have to let it settle."

"I couldn't help it," I apologized.

"We won't have to wait. There's a spring outside," laughed Drake. He picked up the tea kettle and motioned me before him.

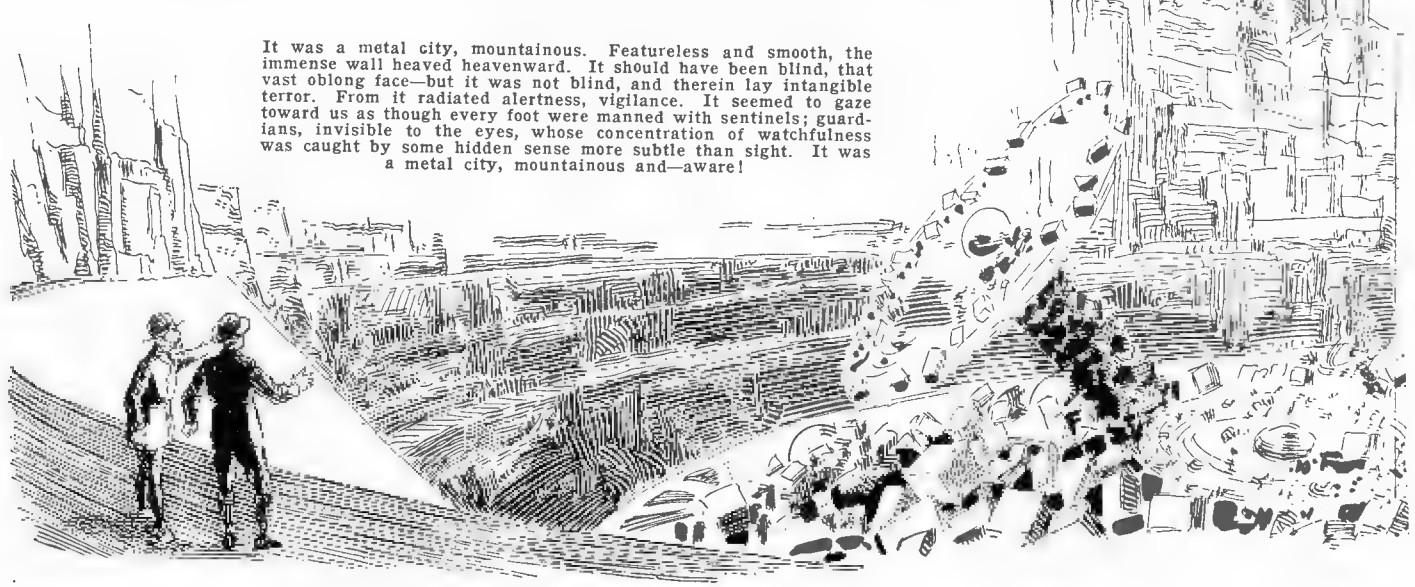
"About Yuruk," he said, when he had gotten outside. "I gave him a little object lesson. Persuaded him to go down the line a bit. Showed him my pistol, and then picked off one of Norhala's goats with it. Hated to do it, but I knew it would be good for his soul. He gave a screech, and fell on his face and groveled. Thought it was a lightning bolt, I figure, and decided I had been stealing—their—stuff. 'Yuruk,' I told him, 'that's what you'll get, and worse, if you lay a finger on that girl inside there.'"

"Then what happened?" I asked.

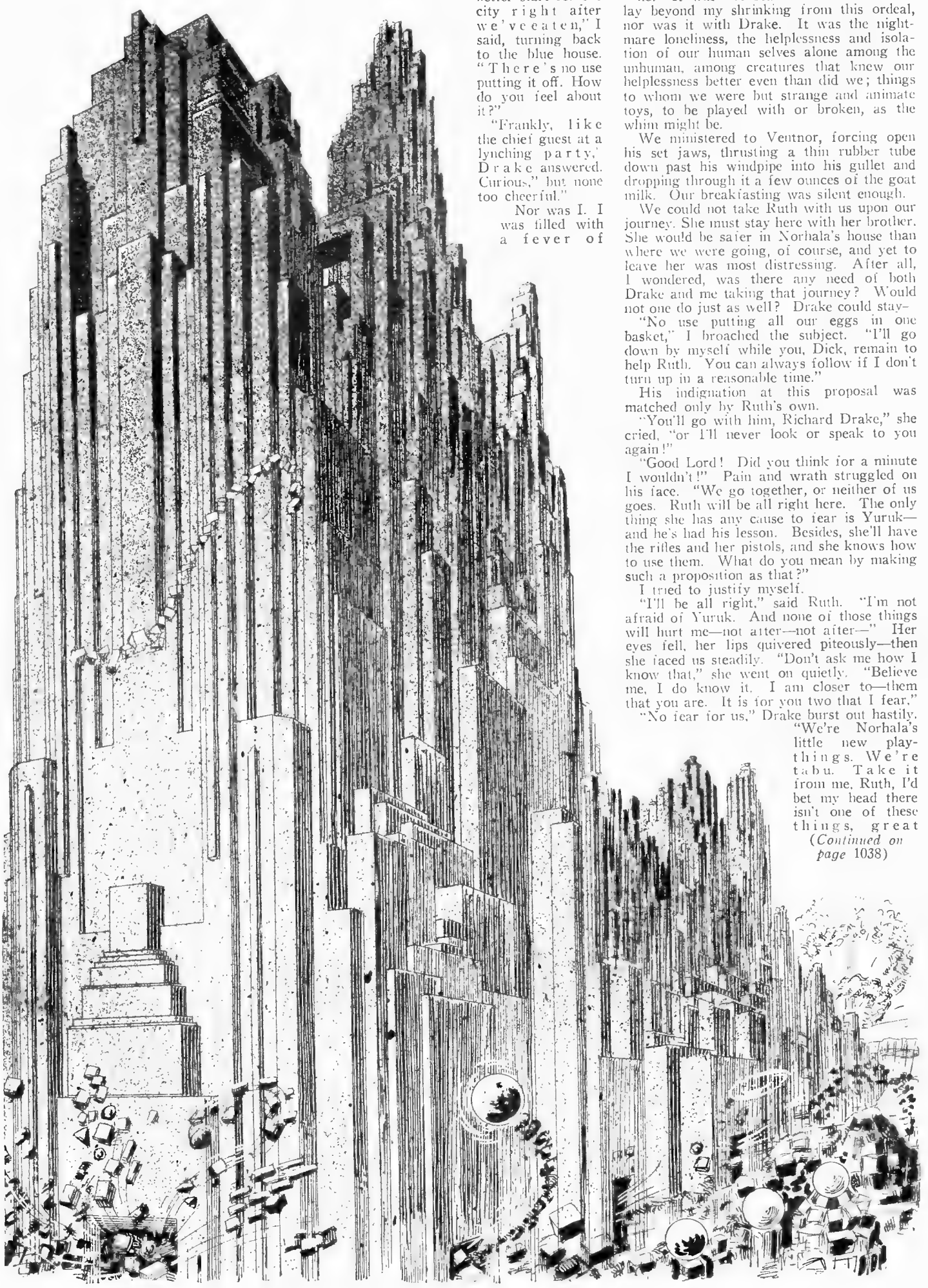
"He beat it back there like an ostrich-legged rooster pursued by a ravenous smoke with automobile feet," he grinned, pointing toward the forest through which ran the path the eunuch had shown me.

Briefly, as we filled the container at the outer spring, I told him of the revelations, and the offer Yuruk had made to me.

"Whew-w!" he whistled. "In the nutcracker, eh? Trouble behind us and trouble in front of us."



It was a metal city, mountainous. Featureless and smooth, the immense wall heaved heavenward. It should have been blind, that vast oblong face—but it was not blind, and therein lay intangible terror. From it radiated alertness, vigilance. It seemed to gaze toward us as though every foot were manned with sentinels; guardians, invisible to the eyes, whose concentration of watchfulness was caught by some hidden sense more subtle than sight. It was a metal city, mountainous and—aware!



"I think we had better start for the city right after we've eaten," I said, turning back to the blue house. "There's no use putting it off. How do you feel about it?"

"Frankly, like the chief guest at a lynching party," Drake answered. Curious," but none too cheerful."

Nor was I. I was filled with a fever of scientific curiosity. But I was not cheerful—no. It was not fear nor cowardice that lay beyond my shrinking from this ordeal, nor was it with Drake. It was the nightmare loneliness, the helplessness and isolation of our human selves alone among the unhuman, among creatures that knew our helplessness better even than did we; things to whom we were but strange and animate toys, to be played with or broken, as the whim might be.

We ministered to Ventnor, forcing open his set jaws, thrusting a thin rubber tube down past his windpipe into his gullet and dropping through it a few ounces of the goat milk. Our breakfasting was silent enough.

We could not take Ruth with us upon our journey. She must stay here with her brother. She would be safer in Norhala's house than where we were going, of course, and yet to leave her was most distressing. After all, I wondered, was there any need of both Drake and me taking that journey? Would not one do just as well? Drake could stay—

"No use putting all our eggs in one basket," I broached the subject. "I'll go down by myself while you, Dick, remain to help Ruth. You can always follow if I don't turn up in a reasonable time."

His indignation at this proposal was matched only by Ruth's own.

"You'll go with him, Richard Drake," she cried, "or I'll never look or speak to you again!"

"Good Lord! Did you think for a minute I wouldn't!" Pain and wrath struggled on his face. "We go together, or neither of us goes. Ruth will be all right here. The only thing she has any cause to fear is Yuruk—and he's had his lesson. Besides, she'll have the rifles and her pistols, and she knows how to use them. What do you mean by making such a proposition as that?"

I tried to justify myself.

"I'll be all right," said Ruth. "I'm not afraid of Yuruk. And none of those things will hurt me—not after—not after—" Her eyes fell, her lips quivered piteously—then she faced us steadily. "Don't ask me how I know that," she went on quietly. "Believe me, I do know it. I am closer to—them that you are. It is for you two that I fear."

"No fear for us," Drake burst out hastily. "We're Norhala's little new playthings. We're tabu. Take it from me, Ruth, I'd bet my head there isn't one of these things, great

(*Continued on page* 1038)

Can You Answer These Scientific Questions?

SCIENCE and INVENTION Magazine readers, especially our thousands of friends in schools and colleges everywhere, have frequently testified in their letters to the editors that they obtain invaluable help from the columns of this magazine, in clearing up technical questions which arise daily. It is a recognized fact that everyone today, including those of both sexes, are expected to have a fairly good general knowledge of the latest scientific developments and discoveries. It is quite impossible to obtain this knowledge of the latest conquests in science from text-books, as they are usually revised but once a year, and in many cases not as often as that. You will find the questions below a good challenge to your knowledge of modern science, and we advise you to form your own answer, before you turn to the page referred to in each case.

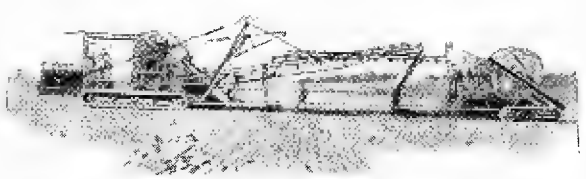
1. What simple, quickly applied scheme would you have used in trying to save the crew of the ill-fated submarine S-4? What is your best scheme for raising a submarine? (See page 978).
2. From your scientific knowledge, do you think it possible for one to make a small, simple device, to be worn about the head, which will provide better thought concentration? (See page 981).
3. From your knowledge of aviation, would you think it possible that a flyer coming out of a fog, might fly his plane skyward instead of earthward, when he wished to land? Again, if the pilot wished to turn to the left, would he actually turn to the right? (See page 982).
4. When a fish expels water past its gills, does this action also help to propel the fish's body forward? (See page 983).
5. Thousands of people have argued the question for generations as to whether or not Siamese twins can be separated. Is it your opinion that this is ever possible? Or only feasible in certain classes of Siamese twins? (See page 984).
6. It has been said that the fatalities among the Pacific Ocean flyers were probably due to the planes going into tail spins. How would you design an improved airplane so as to eliminate the possibility of tail spins? (See page 990).
7. What is a Newtonian telescope? What is a Cassegrain telescope? How can air currents be photographed? (See page 994).
8. Is it economical and practical to use electrical heaters for keeping railway switches clear of snow and ice? (See page 996).
9. If you suddenly found yourself on the moon and beheld the stars, would the stars twinkle? Would the sun appear larger or smaller than on earth, when viewed by a visitor on Mercury? (See page 998).
10. What are the ten most important things to remember when driving an automobile in the winter-time? (See page 1004).
11. Many smokers have no doubt noticed that alcohol does not ignite regularly, when used in pocket cigar lighters. What is the reason for this? (See page 1005).
12. Do you think it is possible for an amateur mechanic to build an accurate barometer with which to foretell weather changes? If so, how? (See page 1009).

Cable Laying Machine

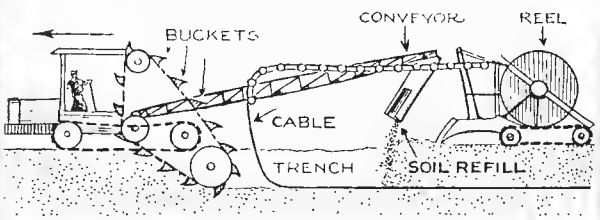
Mechanism Buries Cable Under Ground at Terrific Speed

ELECTRICAL engineering concerns in Germany have made a new discovery in the form of a cable-laying machine, which promises to promote the supply of electrical power throughout the land, at considerably cheaper rates, because there is a much smaller cost in laying cable beneath the soil, than in putting it on poles where it must constantly be serviced. The photographs below show three views of the mechanism. At the front there is a caterpillar tractor provided with an endless chain bucket arrangement, which cuts a narrow trench in practically any kind of soil. The buckets elevate the soil to a conveyor, which carries this elevated soil backward to a chute. Meanwhile, a cable is constantly being lowered into the trench from a cable reel tractor, towed by the digging mechanism. As the cable drops into the trench, the soil follows up in back of it and fills up the cut. The method of operation is explained in the diagram below and is also quite clearly indicated in the photographs. The machine was invented by the director of a large German power plant, who is considerably enthused at the results which have been obtained so far. Operating with but very few men, at a speed of from two to three hundred feet per hour, it both lays and buries the cable.

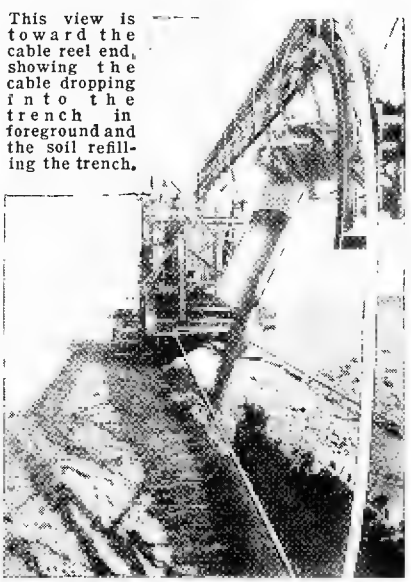
The photo below shows the excavating buckets, the cable, the conveyor, and in the foreground, the refill chute of the trench digger.



The photograph above indicates a side view of the cable-laying machine. Note that the cable reel is mounted on a caterpillar treaded truck, which in turn is coupled to the tractor-excavator. The diagram below indicates the principle of operation.



This view is toward the cable reel end, showing the cable dropping into the trench in foreground and the soil refilling the trench.



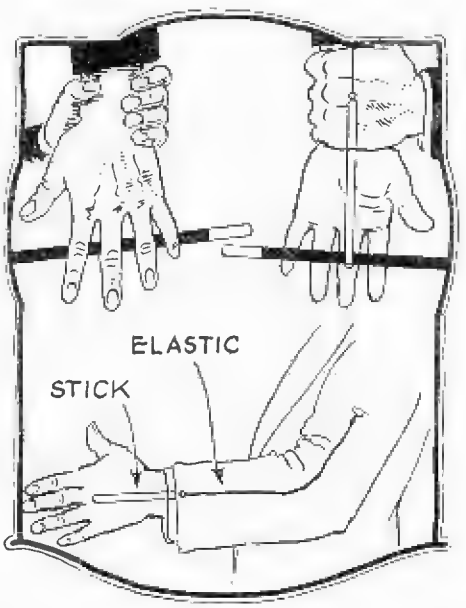
MAGIC

By "DUNNINGER"

NO. 60 OF A SERIES

ENCHANTED SERPENT SKULL

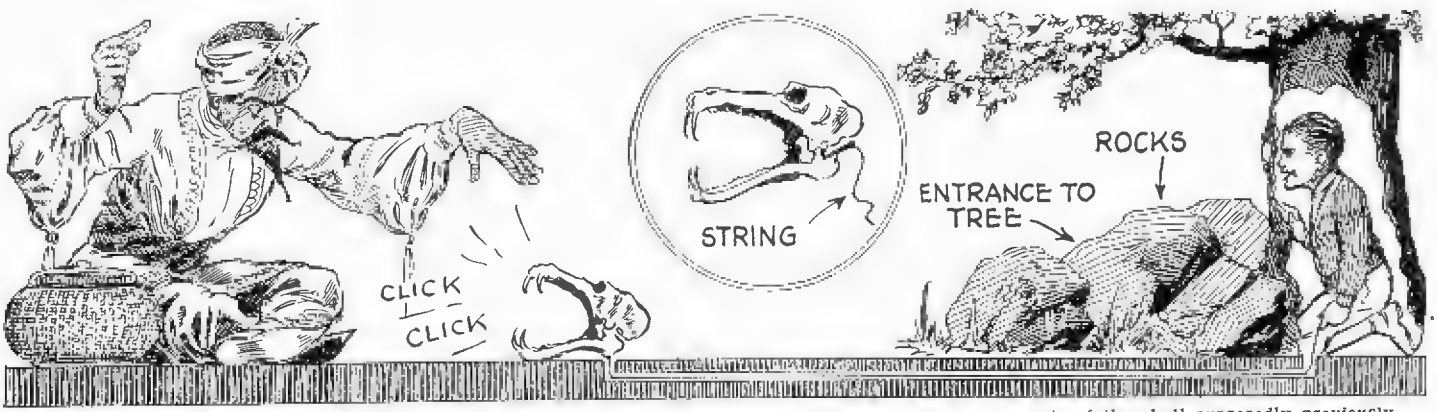
THE illusion below purports to be of East Indian origin and it has been claimed that it is quite common in India. One sees a dark-skinned mystic reach into a woven wicker basket, from which he extracts a small skull. Upon examination, this is found to be the genuine bony substance which at one time constituted the frame-work in the head of a serpent. This snake skull is placed upon the ground directly in front of the seated turban-headed magician. Mystic passes are then made over the skull, the jaw of which is seen to move. The mystified spectators are not aware of the presence of a small boy concealed in the hollow of a tree from one to several hundred feet away. A tube leading from this tree serves as a channel for a piece of thread or thin cord. The free end of this cord hooks to one portion of the skull, and permits the bony structure to rock back and forth on the lower jaw. The lower jaw must, of course, be hinged to the upper and a pair of springs should be added to cause the jaws to close after they have been pulled open by a tug on the string. It is preferable to run a rubber hose beneath the soil several days before the trick is to be produced so that the earth will be properly packed and will leave nothing of which to be suspicious.



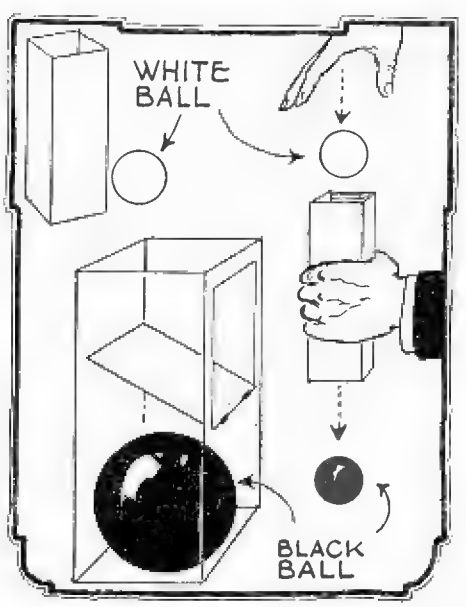
A wand can be suspended from the finger-tips by the aid of a stick as indicated in the diagrams above. The stick slides into the sleeve when not in use.

MAGNETISM

MANY of the readers have undoubtedly witnessed the clever little trick popularly known as magnetism. In this illusion, the magician apparently causes a pencil, ruler, table-knife, or his wand to mysteriously cling to the finger-tips. In the old version of this trick, the wrist of the hand is apparently held for support, but actually, an extended finger of that same hand also holds the article close to the palm. In another form of the trick, a similar effect is obtained by holding a pencil beneath the palm of the hand in such a manner that the pencil presses the object against the palm. This trick has a slight advantage over the first one mentioned, in that the spectators see all five fingers. The disadvantage lies in getting rid of the pencil after the trick has been performed. Hence in this, the new version of the magnetism effect, the writer has employed a stick; but the stick itself is attached to an elastic band, terminating at a safety pin fastened to the sleeve. The methods are just as mystifying and it possesses the additional advantage of permitting the performer to show his hands empty at any moment. The performer can also command whatever it is that adheres to his finger-tips to drop, and can make an attempt to catch it in the air without fear that the gimmick will fall.



A boy in a hollow tree several hundred feet away from the scene of thedemonstration controls the movements of the skull supposedly previously mesmerized by a Hindu mystic. The cord connecting with the skull is run through a thin rubber tube, buried two or three inches beneath the soil.



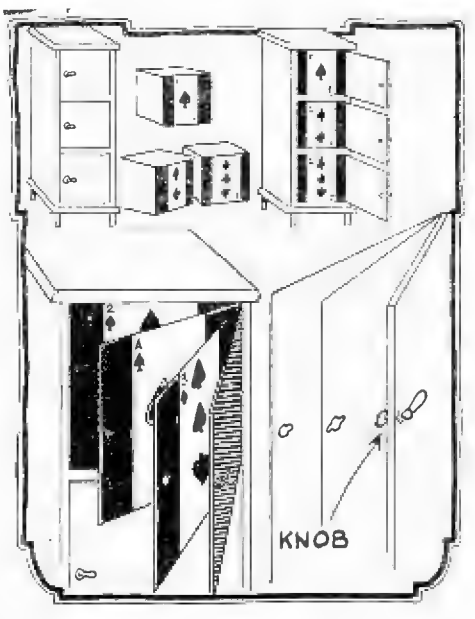
By aid of the tube indicated, a white ball can be instantly converted into a black ball. The white ball previously examined is palmed, and the black one released.

CHAMELEON

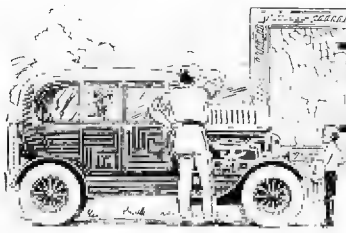
The wizard displays a four-sided tube, open at both ends. A white billiard ball, about 2½ inches in diameter is then passed for inspection. It is dropped into the upper end of the cylinder and falls completely through, but the strange feature is that in falling, it mystically changed in color, becoming a polished black sphere. This ball is again immediately passed for inspection, and the cylinder held so as to enable the spectators to see through it. The diagram explains the mystery. A flap on one side of the tube falls down, causing the white ball to remain above it and release of pressure of the hand permits the black ball to fall. In holding up the cylinder for inspection, the flap drops and the ball rolls into the palm, to be gotten rid of in any desired way.

FIND THE ACE

Three blocks, with cards on their faces, are placed into a three-compartment box. The doors are closed, and the audience is asked to find the ace. On opening the doors again, it will be found that the blocks have changed places. The effect is produced by having two flaps of tin painted to represent the other two cards not in the compartment. Movement of the handle either way will permit either one or both of the tin flaps to remain behind. It is thus possible to control the combination of cards.



Two metal flaps hinged to the door of each of the three compartments permit of a multiplicity of card changes of the card blocks.



Motor Hints

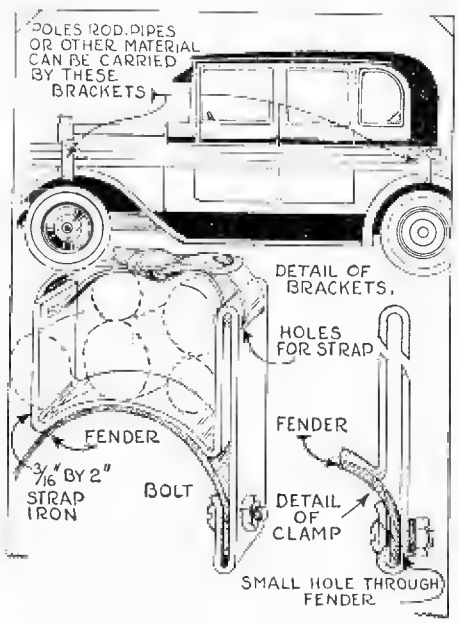
Conducted by GEORGE A. LUERS

CARRYING BRACKETS VERY USEFUL

Many times it is required to haul lengths of lumber, poles or pipes on the car. Delays in fixing up around the home or camp, and hauling expense, can be avoided, if such things are brought along on the car.

By means of two sheet metal brackets and straps, as illustrated in the attached sketch, such unhandy parts can be carried safely, without loss or mutilation of the car-body or fenders.

These clamp carriers can be made up quickly; they detach from the fenders when not in use and stow under the seats. Clamp parts can be bent up cold from strap iron, to approximately the shape of the fenders. The slots are cut in, holes are drilled and the parts are complete. The service of these clamps will repay the owner many times for the spare time and effort put into making them up.



The details of the carrying brackets are shown above. A bracket is bolted to each fender and will be handy when carrying lumber, poles or pipes.

WINTER DON'TS

Safety in Winter driving is dependent in many respects upon the care used in operating, maintainance of mechanism and use of safeguards required by weather conditions. The most prominent details in connection with winter operation are pointed out in the Ilustraton as "DON'TS."

To expand on these points:

It will be understood, if the radiator is not protected by anti-freeze, that a burst system with numerons troubles and expense is certain.

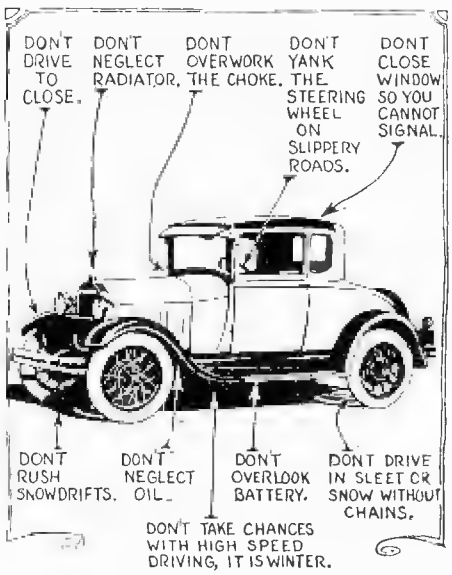
Oil dilution, with burned-out bearings and scored pistons, comes of neglect of engine oil. This should be changed each 500 miles.

Don't use the choke excessively, as it not alone causes oil diluton, but also excessive use of starter and consequently a run down battery. Much gasoline is wasted by leaving the choke out while running.

The battery should be kept fully charged, to prevent freezing, should have water added each two weeks if necessary, to be checked up with the hydrometer.

Chains on wheels are necessary in snow or on ice. Neglect of this carries a risk of injury to car and occupants.

Do not rush the car through a snow drift or mud hole. There is danger of breaking parts in the steering gear or even of collapsing the front axle. Don't twist the steering wheel quickly on icy streets. This starts a front wheel skid and a front wheel skid is dangerous.

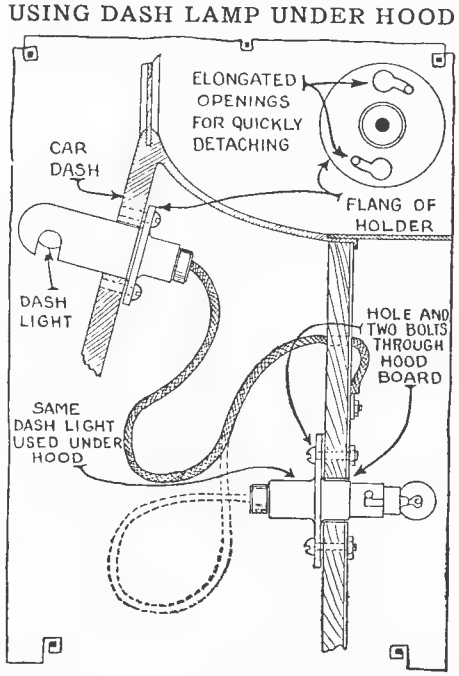

DON'T DRIVE TO CLOSE.
DON'T NEGLECT RADIATOR.
DONT OVERWORK THE CHOKE.
DON'T YANK THE STEERING WHEEL ON SLIPPERY ROADS.
DONT CLOSE WINDOW SO YOU CANNOT SIGNAL.
DON'T RUSH SNOWDRIFTS.
DON'T NEGLECT OIL.
DON'T OVERLOOK BATTERY.
DONT DRIVE IN SLEET OR SNOW WITHOUT CHAINS.
DON'T TAKE CHANCES WITH HIGH SPEED DRIVING, IT IS WINTER.

A number of "winter don'ts" are shown above.

Avoid driving close behind another car or a bus, as it takes room to stop the car when icy spots are on the road. If the car slides a bad collision results. Don't keep the driver's window closed, as signalling is required. Many accidents result from failing to signal.

Winter driving should be attended by extra precaution and care, don't forget it is Winter.

USING DASH LAMP UNDER HOOD


ELONGATED OPENINGS FOR QUICKLY DETACHING
CAR DASH
FLANG OF HOLDER
DASH LIGHT
HOLE AND TWO BOLTS THROUGH HOOD BOARD
SAME DASH LIGHT USED UNDER HOOD

Shown above are the details of dash lamp for the hood.

DO YOU KNOW—the windshield cleaner will not prevent ice forming on the glass. Gylcerine rubbed on with a piece of cloth, will keep ice off for an hour or more. Do not, if you are putting on glycerine use the windshield cleaner or the glycerine film will be removed immediately.

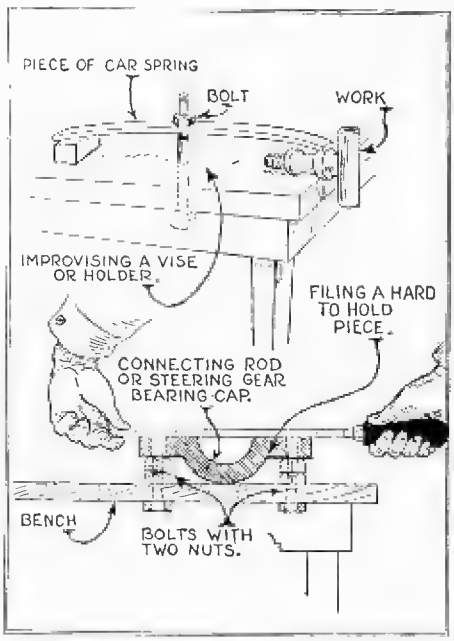
The automobile dash lamp is usually a fixed part, used for lighting up the dash instruments only. The method shown in the attached sketch, gives to the lamp an additional use for lighting up the area under the hood.

A simple alteration, to obtain the added advantage, as shown in the attached sketch. Screw holes in the lamp base flange are elongated and enlarged so to make a bayonet joint, readily detached.

A drilled hole and two screws through the hood board adjacent to the engine allow for quick transfer of the light to this new position when night repairs under the hood are required.

The flexible cord, or conducting wire obviously must be long enough to allow for this change in position.

HOLDING PARTS FOR FILING



Two good methods for holding parts for filing are suggested in the drawing above.

Lack of tool equipment in the repair of the car, can be offset frequently by improvising special holders from odd parts.

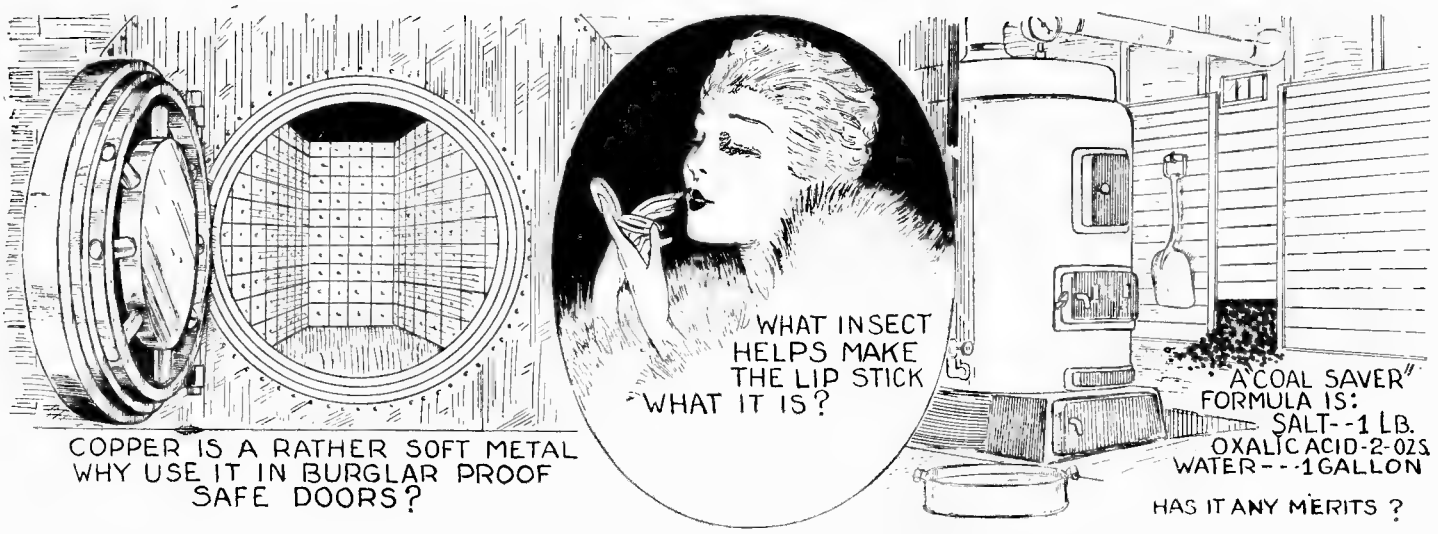
The sketch illustrates holders which have met the average needs in working on parts of the car. A piece of steel, such as a spring leaf, can be blocked at one end, secured with a bolt at the center and the part being worked on is clamped under the opposite end by screwing down the bolt.

Through means of various heights of blocks and a long bolt, this clamp will hold either large or small parts.

(Continued on page 1026)

EVERYDAY CHEMISTRY

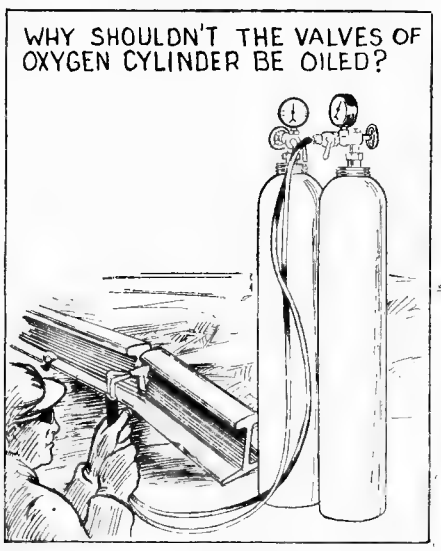
By RAYMOND B. WAILES



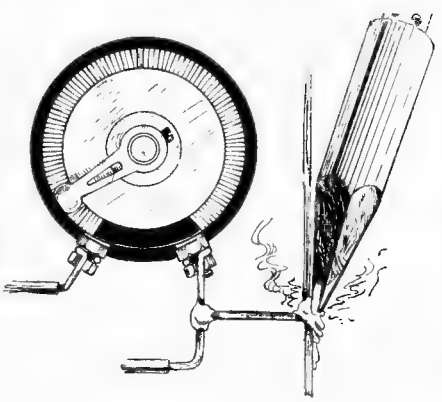
A safe door containing a copper slab twelve inches thick, would conduct the heat from the acetylene torch away from the heated spot so fast that it would require about six hours to pierce the door. Thus copper is better for safe doors than steel would be.

The red coloring matter in many lipsticks is due to carmine, a substance excreted by an insect, namely, the cochineal bug. These bugs when killed and dried by heat yield a brilliant scarlet color.

The above advertised formula has absolutely no merits as a coal saver. There is no accredited scientific basis for this formula and there is no reason why it should be used.



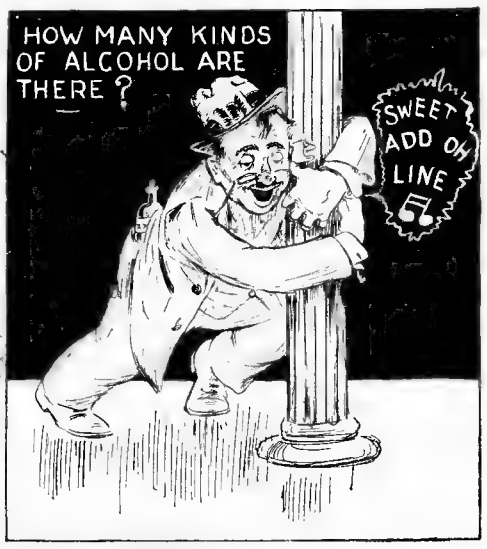
Oil is inflammable. In contact with compressed oxygen, a serious explosion is very likely to take place.



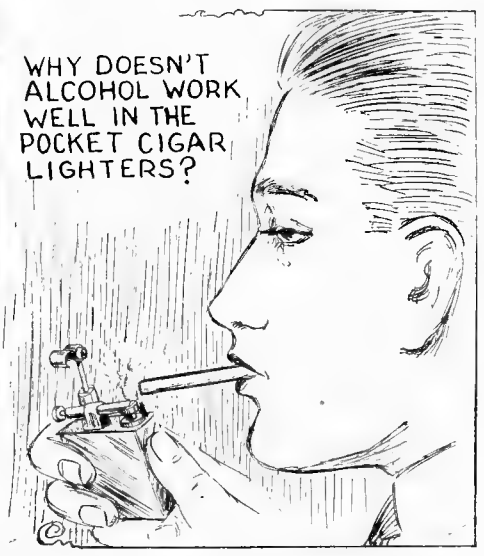
Most soldering fluids contain chlorides. It has been proven that these decompose into hydrochloric acid gas, which in turn drives out the air between the metals, and thus enables the solder to run in, making a tight joint.

For every ton of coal which is burnt in a furnace about fourteen tons of air are needed for its combustion.

Banana oil is not made from bananas. It is largely composed of amyl acetate, which is a very good solvent. It is largely used as a vehicle in gold and aluminum paints.



There are some sixty different kinds of alcohols. Among them are the famous ethyl, the deadly methyl, and also amyl, butyl, propyl, allyl, and cetyl, besides many others.

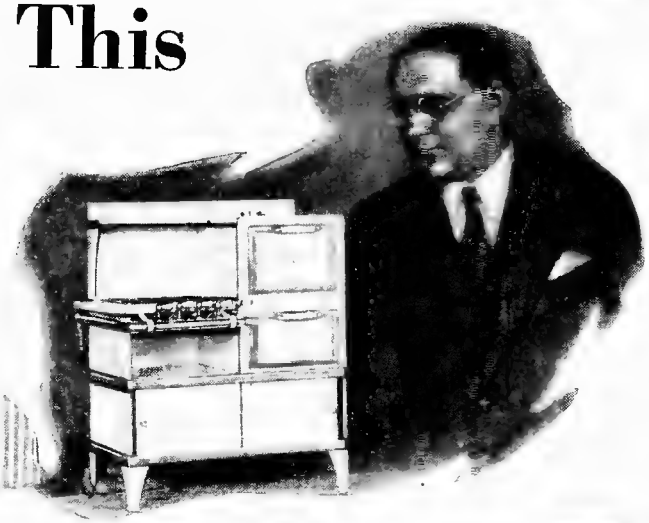


Alcohol absorbs water from the air, until it contains about five per cent of this non-burnable fluid. This added water makes the cigar lighters difficult to ignite when using alcohol for fuel.

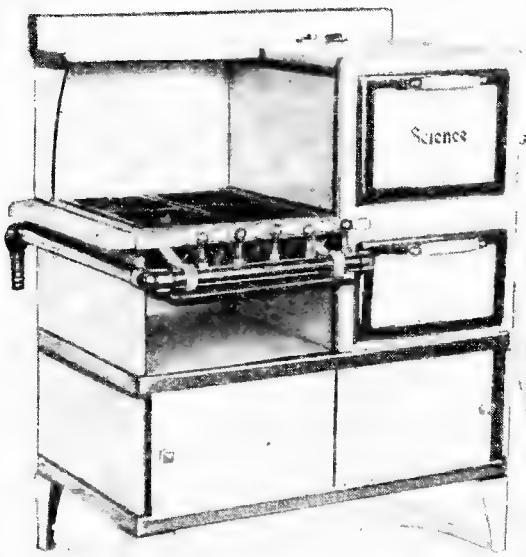
Model Department

Gas Range Wins This Month's Cup

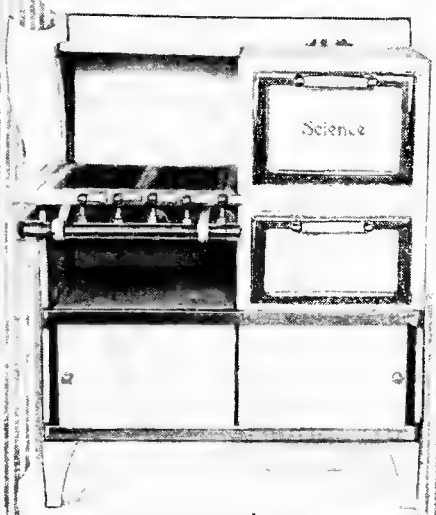
Model Built by Nathan Klein, of Philadelphia, Pa.



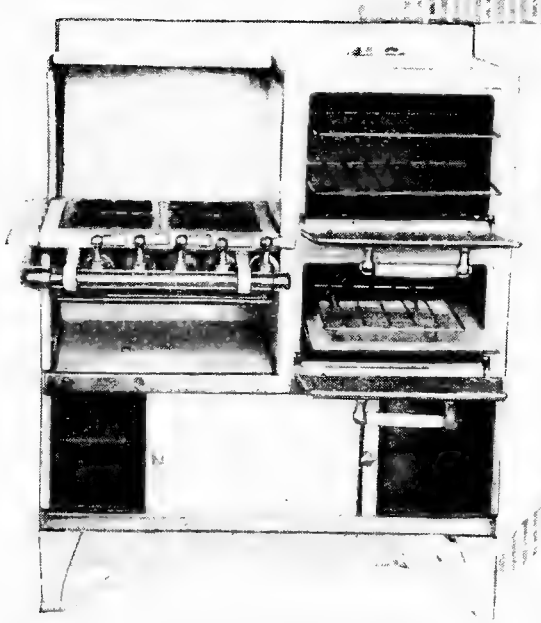
Photograph shows Nathan Klein and his prize-winning model.



This very remarkable model of a range was built of 12-gauge iron and ¾-inch and ½-inch channel iron, entirely by hand. The panels of the doors were hammered out on a piece of lead, to shape them as the photograph shows. No bolts show on this model. It is bolted on the inside as much as possible. Only one pattern was used for the burners.

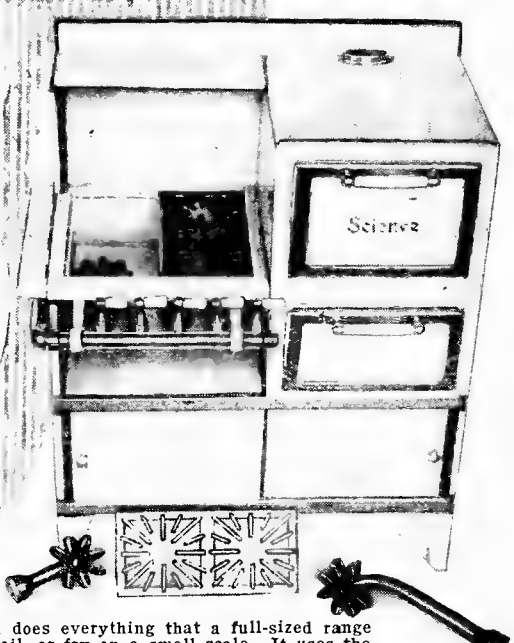


The trophy cup is just 1 inch taller than the model.



The hinges on this model are concealed and the springs are of the invisible type. The handles are of iron filed to shape and then enameled. The knobs are also hand-made with a file, and nickel-plated. The cooking top was made of ½-inch angle iron and the frame was cut out of 16-gauge iron and welded to it.

The photos on either side show the model. The two long burners were made of a piece of ¼-inch pipe, with a ⅛-inch nipple on one side. The other end of the burner is connected to a ⅛ by ½-inch bushing, and the point of a plug inserted and cut out for an air mixer cap.



All the enameling on the model was done at a foundry, after each part had been constructed by hand. The model does everything that a full-sized range will do; it will cook, bake, broil, or fry on a small scale. It uses the regulation illuminating gas. It is 17½ inches high over all, 14½ inches wide, and 8½ inches deep.

(*Rules for Model Contest appear on page* 1044)

The MacLeod Vacuum Gauge

By ED. V. SUNDT

IF you had to measure a pressure one-billionth that of atmospheric pressure; how would you go about it? Its magnitude relative to atmospheric pressure would be as 18 inches is to the 238,000 miles over the distance from the earth to the moon.

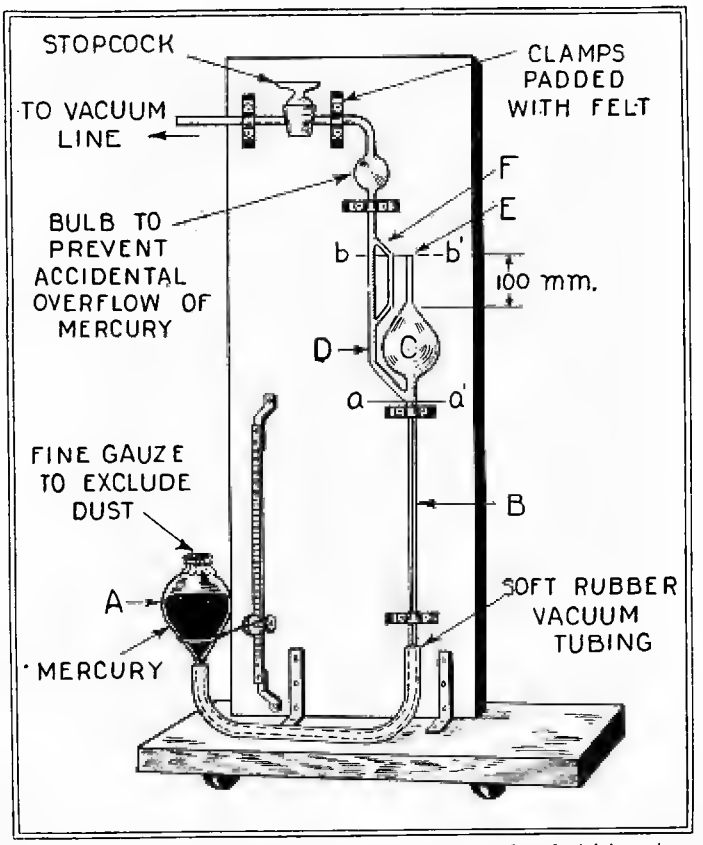
THE MACLEOD VACUUM GAUGE

By means of a glass instrument, known in scientific circles as the MacLeod Gauge, such infinitesimal pressures may actually be "magnified," so to speak, a million times or more, and the pressure read directly in terms of millimeters of mecury. (760 mm. of mercury equals 14.7 lbs. per sq. inch of atmospheric pressure.)

The simplicity and accuracy of its calibration make it popular, not only as a calibration standard for other vacuum measuring devices, but in the manufacture of products which make possible man's greatest achievements. Radio, television, X-ray surgery and other things vital to our present civilization, would be impossible without the use of high vacuum.

OPERATING THE GAUGE

Referring to the sketch, it will be seen, the bulb "A" is a sort of reservoir The mercury is "sucked" up in the glass tube "B" when a vacuum is drawn in the gauge, to about the point a-a¹. Let us assume the gauge has been connected to a vacuum line which has been pumped to .01 mm. of mercury, and we will proceed to take a reading.



The Macleod gauge has been used for many years by electricians in their work on high vacua. The description makes it clear how this very wonderful instrument can be constructed so as to determine the amount of any vacuum, however slight the pressure is.

The bulb A is raised, by means of the hand wheel on the pinion and rack, causing the mercury to rise into the bulb C and the tubes D and F. When it reaches the height *b-b¹* in the tube F which is level with the inside top of the tube E, the reading is taken. Let's see what has happened.

The mercury in rising up the tube D, imprisons the rarified air, or other gas, in the bulb C. As it rises higher and higher in C the residual gas is pushed up into a smaller and smaller volume until at last all the gas formerly in the large bulb is contained in the small tube E, which is usually 100 mm. in length. It is closed, of course, at its top end. The capillary depression offered to mercury by E is balanced by that of the tube F which is of the same inside diameter.

Suppose the capacity of C is 1,000 cubic centimeters, while that of E is .1 cc. One thousand cc. of gas is thus compressed into a space 1/10,000 of its original volume. According to Boyle's law in physics, disregarding the small temperature changes, the pressure of a quantity of gas varies inversely as the volume it occupies. The pressure in E then must be 10,000 times greater than the former pressure in C. The difference in the height of the mercury in the tubes E and F, we find, is 100 mm. In other words the gas pressure in E just counterbalances the weight of a column of mercury 100 mm. high. But the pressure in E is 10,000 times the initial pressure, which then must have been 100/-10,000, equal to .01 mm. of mercury.

The height the mercury rises in E, of course, depends on the degree of vacuum. If it rises to 50 mm. from b-b, the volume of 1,000 cc. would be compressed to .05 cc. or 1/20,000 of its original volume and the original pressure will have been 50/20,0000, equal to .0025 mm. of mercury.

PECULIARITIES OF GASES AT LOW PRESSURES

At about these pressures a gas behaves somwhat like a thick, viscous fluid and flows very slowly. When evacuating a radio tube, for instance, it clings to the glass bulb and metal parts somewhat the same as molasses would if being poured out of a dish.

Cathode rays, formed by the application of a high frequency spark coil to the terminals at this time, will agitate these layers of gas violently and the tube will gradually begin to glow with a white light as the gas begins to get stirred up. What really happens is: the adhering gas molecules are bombarded by the millions of electrons which constitute the cathode rays. The glow disappears again as the tube is evacuated below .005 mm. of mercury. The gas is most effectively driven off, however, by heating the glass to about 400° C. The metal parts are heated to a white heat by means of a radio frequency induction furnace. The heating must be done, of course, while the tubes are being evacuated.

As our pressure decreases the efficiency of the gauge increases in a geometrical progression. Thus at 25 mm. from b-b¹ the initial pressure would be multiplied 40,000 times, which means it must have been 25/40,000, equalling .00066 mm. of mercury. This is approximately the pressure a radio tube is pumped to when being manufactured. The tube "hardens" with use, or in other words, the pressures decrease, on account of the tungsten in the filament combining with the residual gases.

If the mercury comes up to within one mm. from the top of "E" the original pressure would be "magnified" 1,000,000 times and the pressure read would be .000,001 mm. of mercury, which is about the pressure in a good X-ray tube.

The instrument described is known as a 10,000 to 1 ratio gauge, which is the ratio of the capacities of C to E. Small ratios such as 400 or1,000 to 1 are more common, being easier to make. They answer most purposes however, for while their sensitivity is proportionally less it is very seldom a vacuum higher than .000.01 is obtained. To read higher vacua it is also necessary to cool the mercury in the gauge to 0° C. or less, to prevent its vapor pressure from affecting the reading.

In radio work, especially, the determination of vacua in bulbs is of extreme importance, because hard bulbs, containing almost a perfect vacuum and soft bulbs, containing a certain amount of gases must have their pressure accurately determined. There are other uses for this gauge in the electric field as in X-ray work and neon tubes. It is fair to say that the exact determination of low vacua is acquiring more importance as time goes on. It will be seen by reading the article that any degree of sensitiveness may be given to the gauge by changing the proportions of its parts. It is a question of ratios or relations of volumes or rather of cubic contents.

NEON LAMPS IN THE DARK-ROOM

Neon lamps have been recommended for photographers' use in the dark-room. It is to be noted that the lamp should be tested for actinism, as some are unsafe for such use. A noticeable improvement will be obtained when using the right type of lamps.

Water and Its Impurities

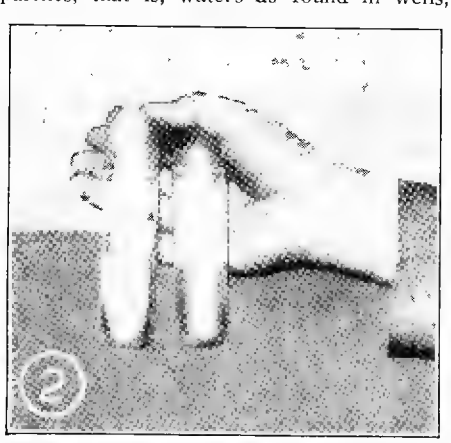
By DR. ERNEST BADE

WATER is taken too much for granted. Although it covers three-quarters of the earth to an average depth of a mile, only a minute fraction of it is fit for human consumption. Before the water can be piped to the users in cities and towns, the water in many places must be purified, and this may be accomplished quite readily by large sand filters, chemicals, and settling tanks. Any of these methods, or a combination of them is used, depending entirely upon the impurities found.

Really pure water is never found in nature, although ice, snow, and rain water are nearly so. Even in distilled water certain impurities may be found if the water distilled contained comparatively large amounts of such volatile substances as ammonia. This ammonia passes over with the first, the later distillate being pure.

Heat the precipitate strongly. If it turns dark, too much organic matter is present. If ignited, a characteristic odor may indicate nitrogenous matter. This odor may even be putrescent.

Water usually contains three types of impurities, that is, waters as found in wells, springs, lakes and rivers. These consist of organic matter, mineral matter, and gaseous constituents. Of the first, that is organic matter, New York City had a taste some years ago when its water supply was infested with a tiny plant giving the water a cucumber-like taste. Such contaminations of water supplies are extremely rare, except in waters that are not used by communities for drinking purposes. Living plants and animals are abundant in some places, as well as dead and decaying organic matter. Then, too, many different kinds of gases are dissolved in the water, such as oxygen, carbon dioxide, nitrogen and, sometimes, hydrogen sulphide, as well as other rarer types.



The presence of a chloride is easily distinguished by the addition of silver nitrate solution to a test portion. The test tube containing the precipitate shows the presence of a chloride. Heat the test tube of water, add a few drops of nitric acid, and then add the silver nitrate.

One of the commonest constituents in water is chlorine in the form of salts. Acidify with a drop or two of nitric acid and add a few drops of silver nitrate solution. A white precipitate or milky appearance shows that a chloride is present.

Sulphuric acid and sulphuric acid salts, sulphates, are detected by acidifying a small portion of the water with hydrochloric acid and adding barium chloride solution, first heating the water nearly to boiling. A white precipitate indicates the presence of a sulphate.

Lime water added to the water (before it is boiled) will show the presence of carbon dioxide dissolved in the water, by giving a white precipitate.

Calcium or lime in water is detected by adding a few drops of ammonium carbonate to a small test portion and then adding ammonium oxalate. If calcium is present, a crystalline precipitate, calcium oxalate, is formed which is white in color.

Magnesium salts are detected by making a small test portion alkaline with a little ammonium chloride followed by ammonium hydroxide and then adding a few drops of bisodium phosphate solution. A white precipitate, crystalline in nature, appears if magnesium salts are present.

The mineral matter found is more extensive and variable. The more ordinary constituents are salts of lime, magnesia, soda, potash and ammonia, and the latter is also found free. Then there may be such acids as hydrochloric, sulphuric, carbonic, nitrous, nitric, and, at times silicic or phosphoric, present. Sometimes even iron and aluminum salts make themselves felt, the former in chalybeate springs, but, usually, the most common are the salts of calcium (lime salts) and sodium.

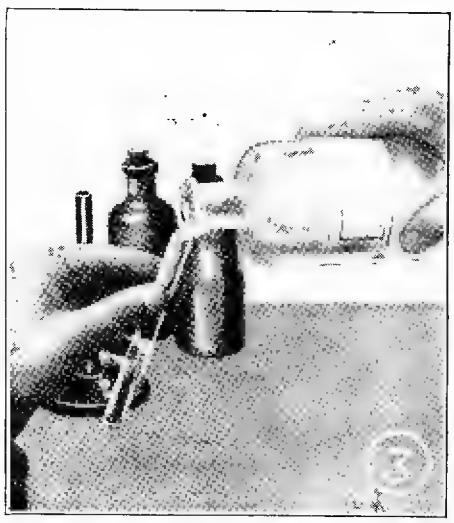
The hardness of water is mainly due to carbonate and sulphate of calcium in the water. The former produces temporary hardness because it precipitates out on prolonged boiling. The latter alone or together with chloride of calcium and magnesium produce permanent hardness. Hard water is not only injurious to health because its power as a solvent for food is impaired, but it directly impedes digestion. It is bad for washing, because a very large quantity of soap is used, first to neutralize the hardness, and then only for its cleansing use. The quantity of soap required for softening the water depends upon the quantity of salts dissolved in it. The calcium carbonate (carbonate of lime) destroys about ten times its weight of soap.

Water affected by temporary hardness may be softened by the addition of sodium carbonate or by boiling for 15 minutes. This removes the hardness. One quart of river water may contain about 8 to 9 grams of mineral salts. A quart of ocean water contains about 40 grams, more than three-quarters of which are common salt.

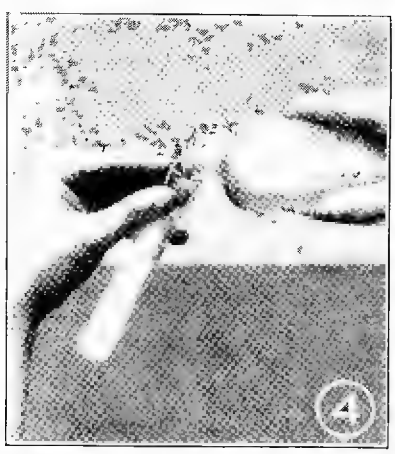
The mineral impurities in water may be found by qualitative analysis, evaporating the water to dryness and testing the residue. For general purposes, it is sufficient to test for some certain definite substance in the original water or after it has been concentrated by evaporation. The latter method is to be preferred.

Iron salts, if present, must be detected either as ferrous or as ferric salts. The ferrous salts are present if the test solution turns light blue when potassium ferro cyanide solution is added; a deep blue color and precipitate is formed when potassium ferricyanide solution is added. The ferric salt is detected by adding a drop or two of chemically pure hydrochloric acid to the test solution and then adding a few drops of ammonium sulphocyanide solution. A deep red coloration indicates the presence of ferric salts.

Salts of aluminum and phosphoric acid are detected by evaporating about 2 ounces of the concentrated test solution until the mixture in the evaporating dish is just moist. Add a few drops of nitric acid (dilute) and divide into two parts. To one part add a few drops of ammonium chloride. Filter if not clear. Then add ammonium hydroxide until the solution smells of it. The presence of aluminum is shown by a white flocculent precipitate. The remaining half of the solution, which is also filtered if not clear, receives an addition of ammonium molybdate solution. Warm the test tube slightly, to about 50 C. A yellow precipitate shows the presence of a phosphate.



Acidify a small portion with hydrochloric acid and then add a few drops of barium chloride. The presence of a sulphate is shown by a white precipitate.



Magnesium salts are detected by making a test portion alkaline with ammonia, and then adding a few drops of sodium biphosphate. A white precipitate forms if such salts are found present.

(To be continued)

The Constructor

How to Make a Barometer

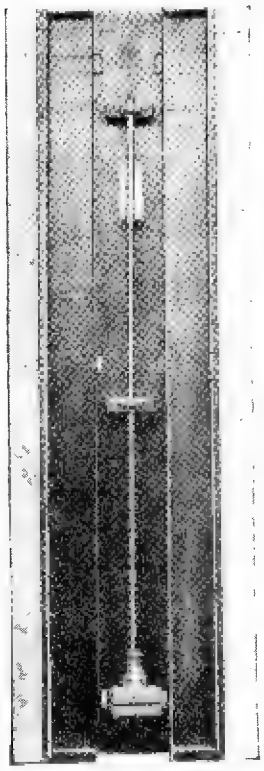
A Cheap and Serviceable Instrument Which Can Be Built at a Cost of Six Dollars

By RAYMOND B. WAILES

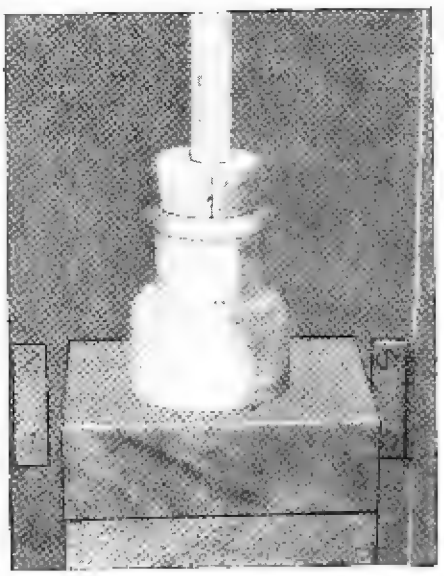
A MERCURIAL barometer can easily be made by the handy man from about six dollars worth of materials. If properly made, it will be of real value to his household, functioning accurately and dependably as all good barometers should. Perhaps past experiences with catgut, hair, gelatin, paper, burned out electric light bulb, dripping bottle, and the host of other makeshift and so-called barometers will deter many a handy man from making a mercurial type of barometer such as described here. But this should not be; the mercurial type is the standard by which others should be judged.

The essentials for the barometer are a barometer tube which can be bought from dealers in chemical supplies for about fifty cents, a bottle, and about two pounds of mercury. The barometer tube is a thick walled glass tube, closed at one end and having about an eighth of an inch inside bore. Lacking a barometer tube, a straight length of heavy glass tubing of about one eighth of an inch or one quarter of an inch inside diameter, about 38 inches long, and closed at one end, can be used. The end can be closed by holding it in a flame, rotating it while it is being heated.

The first step in the making of a barometer consists in purifying the mercury. This can be most easily done by filtering through chamois, or through a very small hole in the end of a paper cone. One of the photographs shows how such a paper cone is rolled to make the filtering, or purifying funnel as it could be called. By pulling up tight, the paper seam can be closed so snugly that no mercury will flow from the cone, and by allowing the fold to slip a trifle, a small hole, which will keep back the dross of the mercury when it is filtered through it, can be had.



The photograph at the left shows a front view of the completed barometer, which can be made at a cost of about $6. Most of the supplies can be bought from a chemical supply house. The barometer tube can be mounted in an open case built especially for this purpose. A block of wood to receive the reservoir is attached to the bottom of the case.



The above photo shows the well of the barometer.

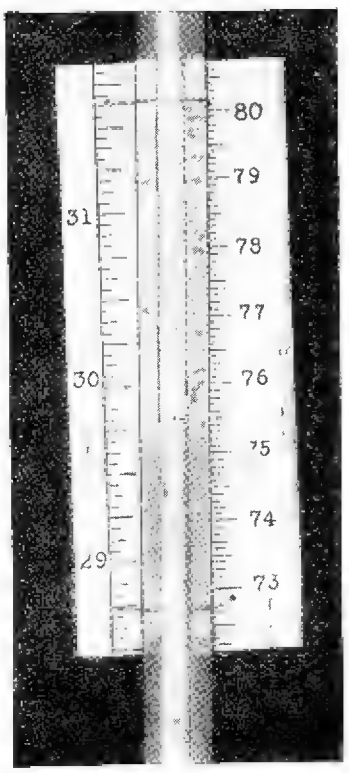
The clean filtered mercury should then be poured into the barometer tube which should be first cleaned with a mixture of sulphuric acid and potassium bichromate, then washed with water, followed by a washing with lye water and then several rinsings of water after which it is dried. The drying is very slow; it can be hastened by rinsing with alcohol a couple of times. By drawing out to a fine point, a length of glass tubing and fastening this to the end of the stem of a small funnel, a filtering funnel will be had which will enable the mercury to be poured into the tube without spilling. Pour in about four inches of mercury. Now with a Bunsen burner, slowly play a flame up and down this part of the filled tube. Soon the mercury will come to a boil, and drive out all the air bubbles between the mercury and wall of the tube. This operation may be omitted if the tube and the mercury is clean, but even then, some inaccurracy of the finished instrument will result. After this boiling, drop in more mercury so that another four or five inches is added. Boil this, and repeat until the tube is filled and at room temperature. Do not attempt to boil all the mercury at once. Tapping the side of the tube will cause the mercury to break up and fall into place in the tube.

The most important part of the barometer construction comes next. This is inverting the tube into a pool of mercury. One way of doing this is to thrust a little leather stopper into the end of the barometer tube so that it is stoppered up, and on inverting the tube no mercury will fall out. Fasten a piece of wire around the leather stopper. Procure a small bottle about three inches high and having a wide, or salt, mouth. Pour enough mercury in this bottle so that when the mercury-filled and stoppered barometer tube is inverted and thrust into the bottle, the end of the barometer tube will be under the mercury which has been poured into the bottle. Now by pulling on the wire twisted to the leather stopper, the stopper can be pulled out of the tube. The mercury will begin to come out of the inverted tube and enter the bottle. If a thirty-six inch tube is used, there will be about thirty inches of mercury still left in the tube.

The barometer tube should, from now on, be handled as carefully as one would a ladle of molten iron. If the tube is raised quickly, the mercury will rise in the tube and whack the closed end of the tube with such force that it might break it, and then again, if it is lowered suddenly, the mercury will fall from the tube, and in reentering, will carry air with it, making the barometer worthless. If one bubble of air is seen bubbling up the column of mercury, the tube should be emptied of mercury, refilled and inverted again, i.e., the work must be done all over again.

The barometer tube can be mounted in an open case built especially for this purpose. A block of wood bored out to receive the well, or bottle-reservoir is to be attached to the bottom of the case. A perforated cork thrust over the tube and into the neck of this bottle-reservoir will keep the tube upright. A very small channel should be cut

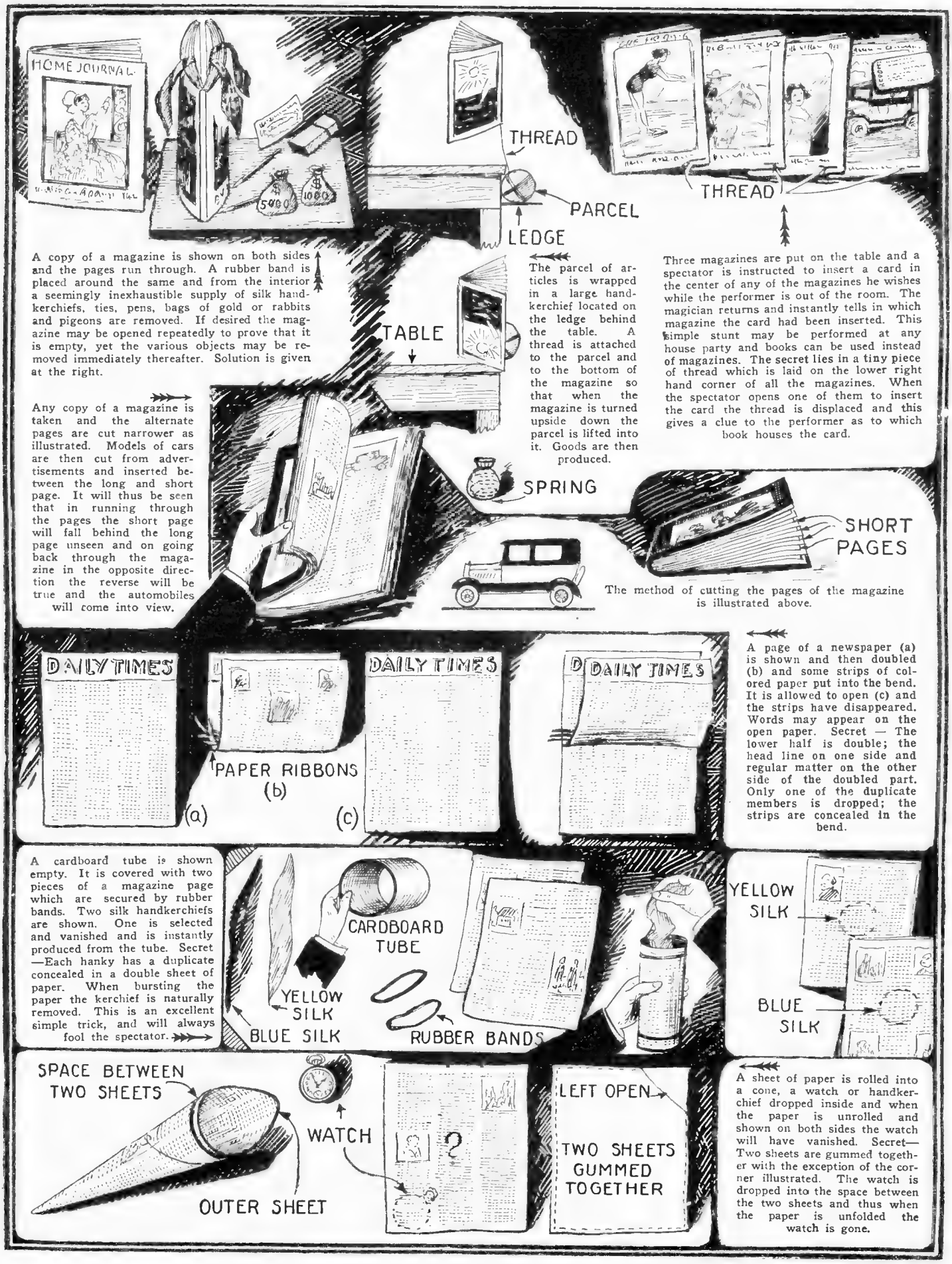
(*Continued on page* 1054)



The scale is fixed behind the barometer tube.

Magazine Mysteries

By BERT DOUGLAS



A copy of a magazine is shown on both sides and the pages run through. A rubber band is placed around the same and from the interior a seemingly inexhaustible supply of silk handkerchiefs, ties, pens, bags of gold or rabbits and pigeons are removed. If desired the magazine may be opened repeatedly to prove that it is empty, yet the various objects may be removed immediately thereafter. Solution is given at the right.

The parcel of articles is wrapped in a large handkerchief located on the ledge behind the table. A thread is attached to the parcel and to the bottom of the magazine so that when the magazine is turned upside down the parcel is lifted into it. Goods are then produced.

Three magazines are put on the table and a spectator is instructed to insert a card in the center of any of the magazines he wishes while the performer is out of the room. The magician returns and instantly tells in which magazine the card had been inserted. This simple stunt may be performed at any house party and books can be used instead of magazines. The secret lies in a tiny piece of thread which is laid on the lower right hand corner of all the magazines. When the spectator opens one of them to insert the card the thread is displaced and this gives a clue to the performer as to which book houses the card.

Any copy of a magazine is taken and the alternate pages are cut narrower as illustrated. Models of cars are then cut from advertisements and inserted between the long and short page. It will thus be seen that in running through the pages the short page will fall behind the long page unseen and on going back through the magazine in the opposite direction the reverse will be true and the automobiles will come into view.

The method of cutting the pages of the magazine is illustrated above.

A page of a newspaper (a) is shown and then doubled (b) and some strips of colored paper put into the bend. It is allowed to open (c) and the strips have disappeared. Words may appear on the open paper. Secret — The lower half is double; the head line on one side and regular matter on the other side of the doubled part. Only one of the duplicate members is dropped; the strips are concealed in the bend.

A cardboard tube is shown empty. It is covered with two pieces of a magazine page which are secured by rubber bands. Two silk handkerchiefs are shown. One is selected and vanished and is instantly produced from the tube. Secret —Each hanky has a duplicate concealed in a double sheet of paper. When bursting the paper the kerchief is naturally removed. This is an excellent simple trick, and will always fool the spectator.

A sheet of paper is rolled into a cone, a watch or handkerchief dropped inside and when the paper is unrolled and shown on both sides the watch will have vanished. Secret—Two sheets are gummed together with the exception of the corner illustrated. The watch is dropped into the space between the two sheets and thus when the paper is unfolded the watch is gone.

A Few Tricks With Magazines

Impromptu Magic Which Can Be Performed by Anyone Without Expensive Apparatus, Using Only Materials Found in the Average Home

IN the first effect which we will describe and which is illustrated on the opposite page, a magazine is shown on both sides. With the inside of the magazine toward the audience, the issue is ruffled out and the pages run through rather rapidly, indicating that there is nothing confined within them, other than the printed matter. The performer leaves the open magazine on the table-top for a moment or two, as is shown, and then turns it upsidedown, so as to show the opposite side and prove that empty. He now proceeds to remove ties, pens, kerchiefs and various other objects from the interior of the magazine. The spectators wonder how this material could possibly have gotten between the pages. The secret itself is quite simple. Suspended from a ledge on the back of the table, the load is tied in a handkerchief and then, by means of a thread, is attached directly to the back of the magazine. When the magazine is turned to apparently show an empty back cover, the thread lifts the load behind the pages, after which the load is opened and the material removed as desired.

The second effect shown is quite self-explanatory. It consists in placing four or more different periodicals on the table-top and asking anyone to insert a card within the pages of one of them while the magician is out of the room. On his return he can tell at a glance which magazine has been opened. Of course, the audience must be instructed to secrete the card near the center fold. The reason for this is that a tiny speck of thread is placed on the lower right-hand corner of each cover. Consequently, when a cover is opened, the thread is accidentally brushed off. This thread is the magician's cue as to which magazine contains the card.

If alternate pages of a magazine are clipped and a photograph or drawing of an automobile is then inserted between each long and short page, ruffling through the magazine from one direction will make the automobile illustrations disappear, whereas if the pages are run through in an opposite direction, an auto will be seen on every one of them.

The fourth effect, illustrated on the opposite page, requires a little imagination to make the modus operandi clearer. At A we see a newspaper which apparently is doubled up as shown at B, and into this open sleeve, pieces of a paper ribbon are dropped. The paper ribbon has previously been torn into short strips, about an inch or so in length. When the newspaper is again unfolded, the strips will have completely disappeared. The secret lies in the fact that two newspapers are actually employed. Let us say the first sheet is used. One first page is doubled on itself so that the running head is facing into the fold. The bottom half is then glued to the complete first sheet, forming a flap, as the detailed drawing shows. It is then obvious that if the back sheet is held, the other piece pasted to it hangs down in a sort of inverted V position. The whole paper is folded up to apparently house the paper ribbons. Thereafter the lower half is dropped, the V-like pocket concealing the ribbons. By adding a second V, it is possible to cause a torn paper ribbon to convert itself into a whole ribbon again. After the trick is produced, the entire sheet is crumpled up and thrown away. In this manner the mode of getting rid of the contents is not observed.

In the next effect, two colored silk handkerchiefs are passed for examination, and then one of them is chosen and handed to the magician. The magician sets this on the table. Now, taking a cardboard tube and tearing two pages out of a magazine, he covers both ends of the tube with a sort of drum-like diaphragm. Vanishing the silk handkerchief in any of the usual ways, such as by the means of a pull, a rubber band or by rolling it into a ball, and while apparently throwing it away, snapping the ball of silk under his waist-coat, he causes the vanished handkerchief to apparently come out of the center of the cardboard tube. The effect is very pretty, because the tube is sealed against any external interference. When the drum-head on either side is burst with the tip of the finger, the kerchief is carefully withdrawn, indicating clearly that it comes from within the drum. The mode of operation is quite simple. A handkerchief is first carefully rolled into as small a pocket as possible, yet with care so that it does not make for bulkiness. This is placed between two adjacent pages of a magazine and the pages glued together. Thus when apparently tearing one page out of the magazine, the magician actually removes two pages, placing the one containing the blue silk handkerchief on one side of the cardboard tube, and the one with the yellow silk on the other side. He can now remove either silk desired.

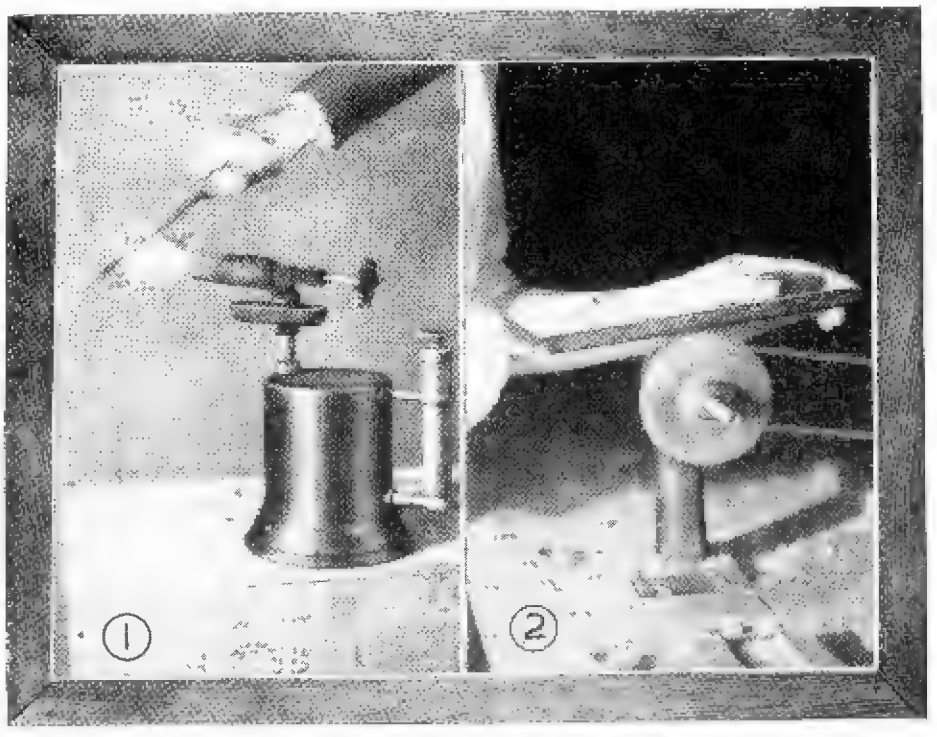
A simple method of vanishing either a watch or a handkerchief is by means of the cornucopia. Here again a page is removed from a magazine ,rolled into a cone and a watch or a handkerchief dropped in. On opening the cone, it will be found that the watch has disappeared. The effect is produced by gluing two sheets of paper together so as to form a pocket, as indicated in the diagram on the bottom of the page.

Making Driftwood Furniture

Articles made of Japanese driftwood always add charm to the room in which they appear. While the photographic illustrations on this page show only a Japanese driftwood photo frame, and the method in which it was made, it is entirely possible to duplicate the effect on wood and then use that wood for the making of small chairs, stools, tables, or, in fact, any kind of furniture desired. Ordinary relatively cheap stools can be converted into driftwood stools by following the method described herewith.

For the driftwood, nearly any kind of wood will do, even that from ordinary packing boxes. One of the best woods is cypress, with a fine curly grain. The material is cut to the desired thickness and width, or shaped to conform with its final desired pattern. Those portions of it which can be observed are then charred with a blow torch, to a depth sufficient to give them a fine, even layer of charcoal. Now with a wire brush, or even a stiff scrub brush, nearly all of the charred wood is removed, the amount depending entirely on the desired color. This wire brushing leaves the hard portions of the grain protruding above the softer and more easily burned wood. A coat of shellac, followed by an application or two of furniture or floor wax, completes the job. Polychrome finishes can be produced on driftwood by painting with one of the new rapid-drying enamels and then, after this dries, covering with a different color, and rubbing down with dry cloth, while the second coat is still wet.

—*Walter E. Burton.*

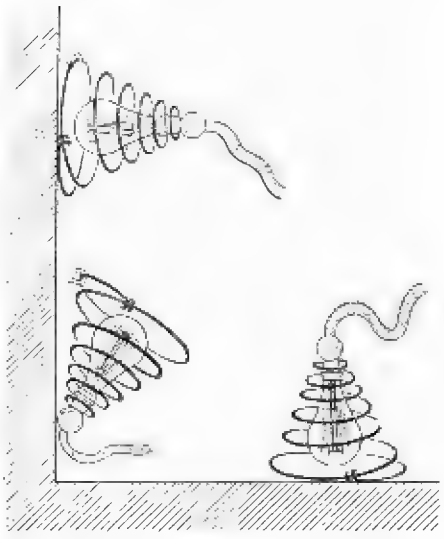


The driftwood frame surrounding the photographs was made in the manner described in the accompanying article. Photo 1 shows charring the wood, and 2 shows the wood being wire brushed.

How to make it

ARTICLES OF INTEREST TO EVERYONE

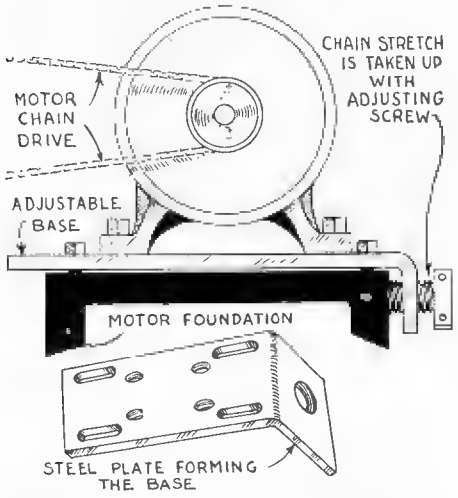
NOVEL LAMP HOLDER



The above illustration shows some of the uses of the lamp holder described below.

A combination electric light bulb protector and holder can be made from a wire spiral and a small wooden knob. The lamp cord is brought out through the top portion of the knob and the wire is fastened to the bottom of this knob. The lamp may be hung in any position or placed on the floor and should prove to be exceedingly useful in the cellar and in the garage. Heavy wire, which will hold its shape well, should be used for the spiral. A chair spring would supply the wire.

IMPROVED MOTOR BASE

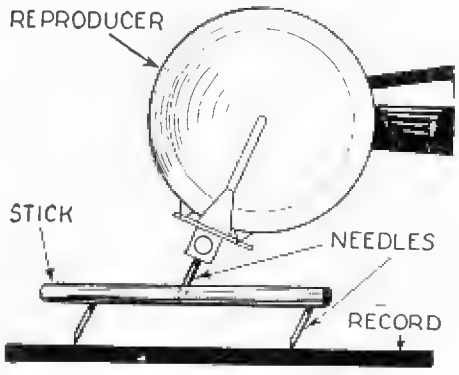

CHAIN STRETCH IS TAKEN UP WITH ADJUSTING SCREW
MOTOR CHAIN DRIVE
ADJUSTABLE BASE
MOTOR FOUNDATION
STEEL PLATE FORMING THE BASE

The above drawing shows the construction of the adjustable motor base for keeping the drive tight.

For maintaining a drive chain under the proper tension, one of the most practical means is to mount the motor on a base similar to that shown in the illustration. A steel base plate is made with holes for securing the motor and slots for the bolts to allow for end adjustment. A section of the plate is bent and fitted with an adjusting screw. It is possible to use this adjusting base without change in the installation.—*G. A. Luers.*

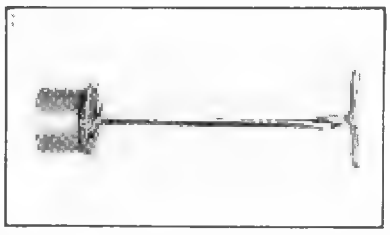
DOUBLE MUSIC

Many unique effects can be obtained by playing two or more grooves in a phonograph record, at the same time. Take a soft piece of wood and drive it into the phonograph needle as shown. Next, take two other needles and drive them into the stick, one at each end, with their points projecting. These should be parallel to the first needle. An arrangement of this nature will give what is known as an "echo effect."—*Ellis L. Roney, Reporter No.* 28403.



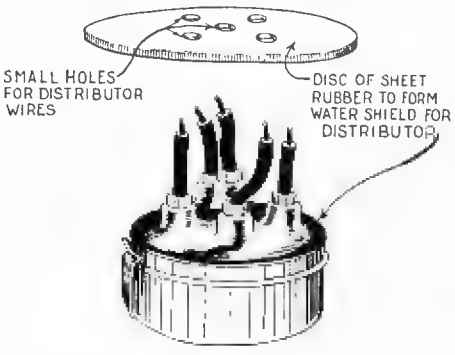
The details of the double reproducer for the phonograph are shown above.

GREASE CUP KINK



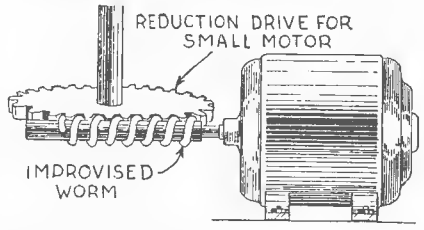
Small grease cups, inconveniently located, can be easily removed by soldering a long cotter key to the cap. The two halves of this key will have to be bent at right angles as shown. The other key forms a handle and is placed through the eye of the upright key. —Frank W. Bentley, Jr.

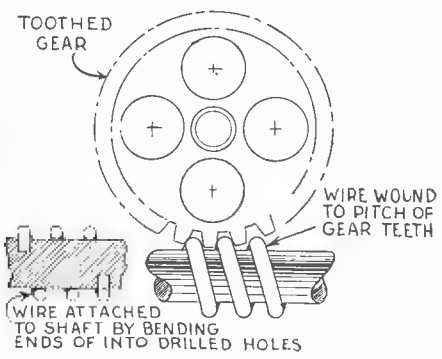
PROTECTING THE IGNITION



The distributor on the automobile may be protected against water as shown. A disc of sheet rubber forms a water shield. Small holes will have to be cut in the rubber to allow for the passage of the distributor wires. —G. L.

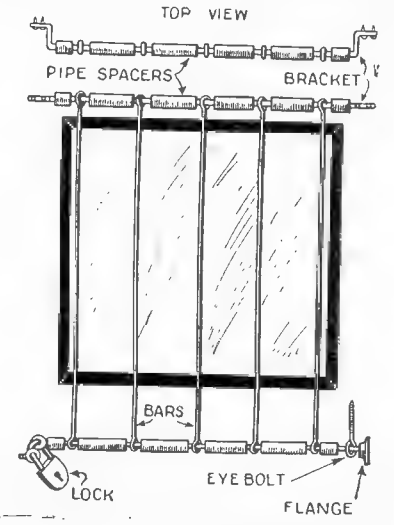
IMPROVISED WORM DRIVE





One of the simplest forms of making a worm drive is through the use of a toothed wheel and a worm made by coiling and fixing a piece of wire to the shaft. The wire should be wound to the same pitch as the gear teeth. The ends of the wire are fitted into holes drilled in the shaft and is thus kept in place. The body of the worm can be made from a piece of brass, drilled to fit the motor shaft. The simplicity of this idea should appeal to mechanics doing experimental work.—G. A. Luers.

REMOVABLE WINDOW BARS



Removable bars for the window may be made as shown above.

Many shops and factories have the windows barred with iron or steel. In the case of fire this may prove to be disastrous, and the illustration shows a means of allowing these bars to be removed. The bars are spaced by pieces of metal tubing. Instead of the lock, as shown, an ordinary pin or bolt with a nut at one end may be used. When it is necessary to use the window as an exit, the flange is removed and the bottom bar slid out.—*Herman R. Wallin.*

Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them, whether caustic or not. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words or less, and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

TRUE!

Editor, SCIENCE AND INVENTION:

Though an astrologist, I did not enter your contest, as I considered it a waste of time and effort.

Nevertheless, I want to make a prediction and that is that you will never award a prize in your astrology contest. Your articles have been so unjust, so bitter and so prejudiced, that to award a prize would mean that you must acknowledge that there is something in astrology and this you would not have the courage to do. So you will quibble, hedge and equivocate, and find a lot of excuses why no prize should be awarded, just as you have done in other matters.

This is a prediction that is going to come true, which the poor contestants have not realized as yet.

E. T. JOHNSON.
Pleasantville, N. Y.

(More than a year ago, SCIENCE AND INVENTION Magazine predicted that the astrologers could not give a correct horoscope. At this late date you have finally come to the conclusion, perhaps through astrology, that no prize will be awarded. We certainly would not consider this an example of a forecast.

But we did not quibble; we did not hedge, or equivocate; the only reason we gave as to why no prize was awarded was because no astrologer could even approach the conditions imposed upon him. In not one instance did we have a horoscope that even approximated the facts. We published some examples; the others are on file at these offices. If any astrologer believes we were unjust in announcing that no rewards were paid, and if he believes that the horoscopes which he drew up are accurate, now that the facts are known, let him immediately write the editor. —EDITOR.)

A BOUQUET AND A KNIFE

Editor, SCIENCE AND INVENTION:

From reading your magazine for some years, I notice you are good enough sports to stand being approached with a bouquet in one hand, a knife in the other, and a sheaf of suggestions, good, bad, and indifferent, in the pocket.

The Bouquet. You are to be praised for your attempt at all times to explain how and why devices work. Some other magazines are full of photos of ingenious devices and of some alleged designers of same, but with no rational explanation of the scientific basis. Some of your minor departments have contained (in small print) some wonderfully clear and succinct explanation. I noted some very excellent work at times in your "Radio Oracle and in your "Patent Advice." The subjects of television and allied branches have been excellently dealt with, as far as a magazine of your scope can go.

The Knife. I recognize that you are a commercial proposition and that after hearing from all your readers, not only from me, you have to decide what will best sell your wares, but still I wonder if you have not at times deserted your best field in a short-sighted attempt to get immediate circulation, instead of looking to a steady future with permanently attached readers.

I think there must be a large and principally unworked field along the lines of your old *Experimenter* on a wider scale. There must be (in fact there are) millions of men and women interested in science and its results and methods who deserve up-to-date information on devices and principles, and many of these are in the class of amateur inventors, who want information as to the prior state of the art and as to unutilized phenomena.

Suggestions. There is, of course, a field for "wonder," viz., the statement of great achievements for us to marvel at and admire, but a little of this goes a long way. We do not get really excited, we amateurs, until we can reasonably imagine ourselves doing the work. That is why radio, at which everyone could tinker, and now television, have so great an appeal and also why, I venture to bet, radio will fall off in popular favor; viz., because the achievement of any results in it, is rapidly getting beyond the amateur's powers. One is therefore driven back upon substitutions, viz., cheaper home devices for expensive factory ones, or into little explored corners (see success of amateurs in short wave work) wherein an amateur may possibly stumble on something novel. To us amateurs, reliability as well as clearness, is an asset.

The amateur lacks knowledge, he needs a "clubbable" kind of paper to which he can submit his half-baked ideas and get help and information without being made to feel that he is an intruder. You have the friendly cordial manner for that and you have the knowledge or at least access to it.

Personally you are slaying the slain for me when you tackle astrology, second sight mediums, etc., but I grant that human nature loves a fight or to read controversy within reasonable limits. Your Ionaco articles, etc., are excellent from that viewpoint and there is a field there capable of expansion by one applying psychology to editorship, as your editor does, though with certain lapses.

Herewith are a bundle of semi-scientific suggestions or queries:

1. The amateur inventor comes in the second rank of science. After the phenomenon or principle is discovered he finds a use or a second use for it. Science text books do not cater for his needs. He wants a list of phenomena and principles and of the uses they have been put to. He has to and is quite willing to grant that the scientists who discovered the phenomena or principles knew their business and, therefore, is only slightly interested in the scientific and mathematical discussion that the specialized expert revels in. For example: (a) granted the "Edison effect"—find a use for it—answer (by Fleming) the two electrode vacuum tube. (b) Expansion of gas under heat—use for it—steam and gas engines. (c) "Hall effect"—uses—what are they?

2. Inversely he needs a list of known means to produce a result e.g. detection of radio waves—crystal—audion—mercury carbon—electrolytic—magnetic detector, etc.—in order to see if his idea has been heretofore used.

AMAZING STORIES

IN THE MARCH ISSUE

TEN MILLION MILES SUNWARD, by Geoffrey Hewelcke. We wager that the interest that this story will arouse will be as great as that of "Doctor Mentiroso." While it has nothing to do with the Fourth Dimension, it evolves a most novel point to change the axis of the earth by human energy. It is one of the cleverest stories of this kind that we have ever seen. And when you have finished the story, we will ask you what is wrong with it.

BARON MÜNCHHAUSEN'S SCIENTIFIC ADVENTURES, by Hugo Gernsback. In installments 3 and 4 the wily Baron gives us in detail a picturesque story and description of his space flyer, his trip to the moon, his landing on the moon and his views of the earth from the moon.

LAKH-DAL, DESTROYER OF SOULS, by W. F. Hammond. Here is a story that contains good science, thrilling episodes and tense situations and will remain a vivid memory for many years to come. If you are at all addicted to nightmares, don't read this story at bedtime.

THE MASTER OF THE WORLD (a Serial in Two Parts) Part II, by Jules Verne. In this installment, the uncanny appearances and disappearances of the mysterious thing that threatens the safety of the world continue, until Strock, the Inspector of the Police and head detective, solves the mystery in an extremely unexpected manner.

And others.

3. Is not static electricity too much neglected these days? Could not interesting work be done with it in radio?

4. Dry piles (Zamboni) could these be used, with suitable resistances for voltage drop, in place of "C" or "B" batteries?

5. Wanted—articles on "present state of art" in each branch so that the amateur inventor can know what has preceded him even though obsolete, so that he shall not waste time and money in reinventing.

6. Radio waves are electro-static and electro-magnetic from different viewpoints at any given moment, the earth is a magnet. Does a transmitter cause fluctuations, possibly locally limited, in terrestrial magnetism and is this why subantennas are successful?

7. Antenna and ground—are they so essentially different—the antenna is a conductor plunged in the air and the ground, a conductor plunged in the earth which is in contact with the air and magnetically one with it. May the true difference not be the distance between them; i.e., that two antennas or two grounds distant an appreciable fraction of a wavelength from one another are receiving when the waves are in different phase (at least partly different)—the most powerful effect would be between conductors plunged at points half a wavelength apart (obvious precautions in experiment needed as the intermediate conductor is itself an aerial and condenser.)

8. Proceeding on the idea of No. 6 above, has it been tried to discard "aerial" transmission, and to devote attention to producing earth waves. Not that I suggest this to supplant the present system, but merely for experiment.

9. Given a source of light waves, unvarying, one can modulate same for signal purposes with a mirror, i.e., heliograph and Bell and Tainter's experiments on photophone down to present day work on phonofilms. Now why not; if given an unvarying source of (short) radio waves, modulate same at and by the reflector? If feasible, this would allow the heavy machinery of the transmitter to be fixed, while the modulator was moving round. At present I can easily see only very short waves could be used and for short signal distances, but experimentation and improvement may produce something practical.

A. MASON,
Victoria, B. C., Canada

THE EDITOR REPLIES

(We thank you both for your bouquet and even felt a pleasurable sensation as you wielded the knife.

SCIENCE AND INVENTION Magazine has always tried to explain the way things work. We have not entered into the very heavy constructional articles, because the construction of a bridge or a building is that type of engineering in which most of our readers are not interested. It is only the outstanding marvels in this field that are covered, but we daresay that there is no publication in the world that has covered the subject of television as completely as SCIENCE AND INVENTION and her sister publication, RADIO NEWS. There is a book called, "All About Television," containing some of the articles which appeared in SCIENCE AND INVENTION. It has 112 pages and is of the same size as this magazine. If you are interested in that subject, we recommend this publication.

We do not agree when you say, that the amateurs are being rapidly driven away from the construction of large size radio sets by factory built models. As a matter of fact, an amateur will always be one; he delights in working up new circuits of his own or in building apparatus embodying the new circuits which are described in various publications. Many manufacturers are slow to take advantage of new circuits, so that the active amateur is always a step ahead.

We likewise believe that this publication offers any reader an opportunity for getting information and at no time is he made to feel that he is an intruder. It is conceivable that it is quite impossible to answer each and every communication that comes in, but we try to do our best.

Taking your queries and suggestions in order:

1. The Edison effect, the two electrode vacuum tube, new styles of gas engines and steam engines, as well as the Hall effect, have all been described in past issues of SCIENCE AND INVENTION in rather full detail.

2. In the series of articles on The How and Why of Radio, subsequently published in book form, the crystal Audion, mercury-carbon, electrolytic, magnetic, dry electrolytic, Bunsen burner detectors and various other styles were described. Of course, it would be of no particular value to republish a historical resumé which had already been published in back issues of this magazine.

3. Unfortunately, very little can be done with static electricity in radio, while its elimination from radio would be a valuable asset.

4. Dry piles have been described. The current which they produce is so short in duration, due to polarization exhaustion and the constructional cost so great, as to make such batteries worthless in the radio field.

5. This is a hopeless quest. It would be impossible for any publication to give the present state of art on any subject and cover the patent situation on the same subject. The U. S. Patent Office has issued nearly two million patents, but what they cover cannot be told by even an experienced attorney, prior to court litigation. For instance, Dr. deForest thought that he was the inventor of the Audion, or three electrode vacuum tube. Later the courts decided against him; and still later have decided in his favor.

6. Transmitters have no effect on local or terrestrial magnetism. Subantennas are successful, but not for this reason.

7. The distance between the antenna and the ground has of course quite an effect in the transmission of radio messages. The smaller the distance, the shorter the range with the same amount of power and at the same wavelength. Short waves seem to carry exceptionally well with a minimum amount of power. In this case, antenna and counterpoise are generally quite close to each other.

8. Transmission of earth waves is done in the case of submarines and likewise in the case of sub-antennas or underground antennas, so successfully demonstrated during the war by Dr. James Harris Rogers.

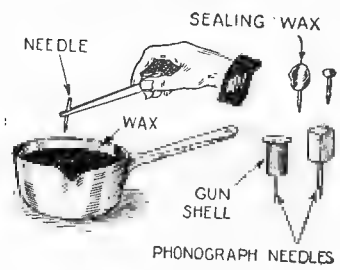
9. The suggestion advanced in your ninth query is possible. The difficulty is in producing a reflector which would cut off the radio waves and then permit them to pass rapidly enough at a speed capable of modulating the wave. Moving the reflector around is not a new idea and an article on this subject appeared in past issues of this magazine, where moving reflectors were used for directive or beam transmission at lighthouse stations.—EDITOR.)

Wrinkles

RECIPES & FORMULAS

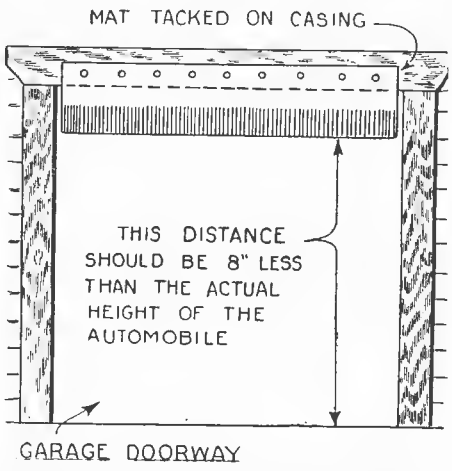
Edited by S. Gernsback

PUSH PINS



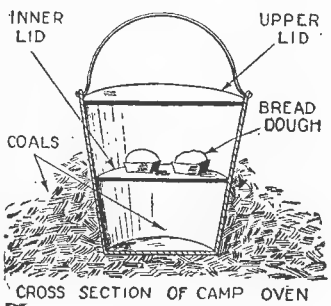
Very good push pins can be made by dipping old phonograph needles into molten sealing wax. They are dipped several times to make a large head, which may be molded with the fingers in various shapes before the wax hardens. An empty shell, filled with wax, with a needle inserted as shown, also makes an excellent push pin. Small-headed pins of various colors used to mark maps and charts may also be made in this manner.—D. S. Jenkins.

SNOW CLEANER FOR AUTO TOPS



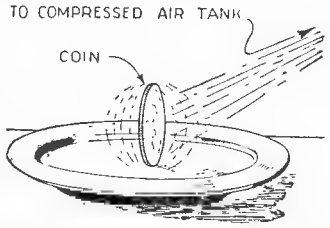
A strip of an old mat about 16 inches in width can be easily made into a cleaner for automobile tops. A number of slits are cut in one side of the mat and should be about 3 inches deep. The mat is tacked on the casing of the garage door, not eight inches less than the height of the auto.—Fred White.

CAMP OVEN



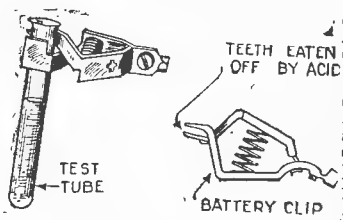
A handy camp oven can be made by taking an old bucket with a lid and inserting a smaller lid into it, about one-half the way down. Grease the inner lid and set the improvised baker upon a pile of warm coals and place others about the sides. Agate or tin buckets may be used very nicely.—Amos Roberts Sweet.

SPINNING COIN



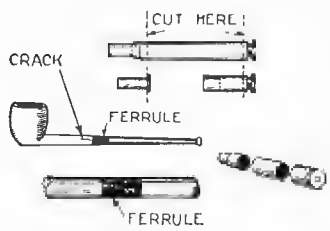
If a stream of compressed air is played upon a spinning coin, the coin will be kept within the range of the stream and will appear to spin of its own accord, creating a very puzzling and interesting effect. The coin is given an initial spin with the fingers and continues to spin as long as the compressed air is directed upon it.—W. F. Crist.

TEST TUBE HOLDER



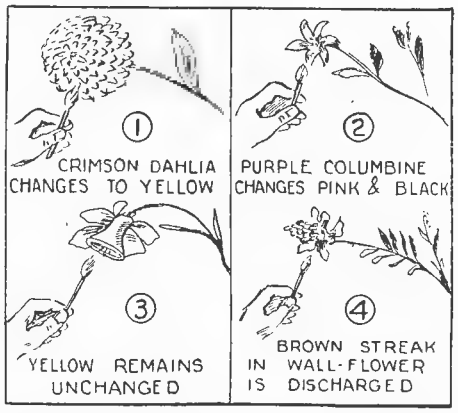
Old battery clamps which have been discarded because their teeth have become eaten away by acid, make excellent test tube holders for the laboratory, as shown in the illustration. The clamps may also be used for many other purposes in the experimenters' laboratory, and the spring on the clamp will provide enough tension to hold all apparatus tightly.—Miner M. Hemeon.

REPAIRING PIPE STEMS



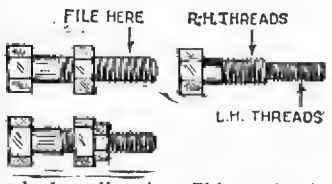
Empty rifle and pistol cartridges are extremely handy around the shop or home workbench. They are available in sizes up to one-half inch in diameter and make excellent ferrules and reenforcing bands for small repair jobs on split canes, cracked pipe stems and the like. They may be polished, plated, or finished in any way desired. The cartridges also have sufficient strength to withstand all ordinary usage which is given to small articles. The illustration shows how a cracked pipe stem may be repaired.—Edwin D. Merwin.

FLOWER EXPERIMENTS

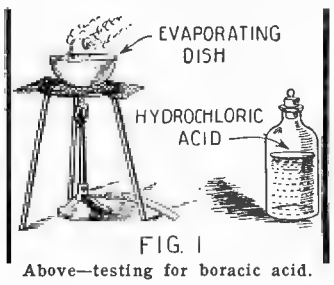


Many interesting experiments can be carried out with the aid of flowers and matches. A crimson dahlia held over a match changes to a perfect yellow. A purple columbine changes to pink and then to black. Other experiments appear in the illustration.—Vernon Miller.

SIMPLE LOCK NUT



A simple lock nut arrangement can be made as shown in the illustration. The end of the bolt is filed until the extending portion is of a standard smaller size. This portion is now cut with left-hand threads. The tendency for the larger nut to turn will tighten the smaller one as both nuts turn in opposite directions. The bolt should first be screwed in position, so that one can find out just how far to cut the left-hand threads. The smaller nut should fit snugly against the larger one.—T. F. Maher.



Above—testing for boracic acid.

METHODS OF TESTING MILK

In order to test milk for boracic acid, evaporate a small quantity and incinerate the residue. Add hydrochloric acid and dip tumeric paper into the solution. If the paper is stained red, boric acid is present. After the milk has been evaporated, the residue may be treated with hydrochloric acid for the detection of carbonates. Boiling the milk with hydrochloric acid and iron chloride is a good test for formalin. If milk is shaken with ether and the ether solution evaporated, a test for salicylic acid can be made. Alcohol and iron chloride are added and a violet color is discernable if this acid is present. The drawing shows the procedure for making the test. The milk should be underlayed with sulphuric acid containing a trace of iron chloride. A violet-blue zone will form if formalin is present. Ferric chloride when added to an aqueous solution besides salicylic acid produces an intense bluish-violet coloration. When adding a small portion of salicylic acid with some concentrated sulphuric acid and then dropping in methyl alcohol continuously and heating the mixture to boiling, an odor of oil of wintergreen is produced. Milk should be free from preservatives.—*Joe Sill.*

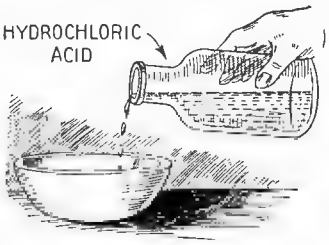
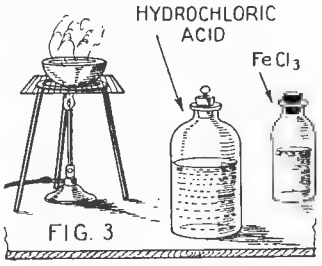
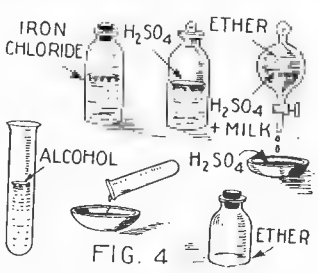


FIG. 2

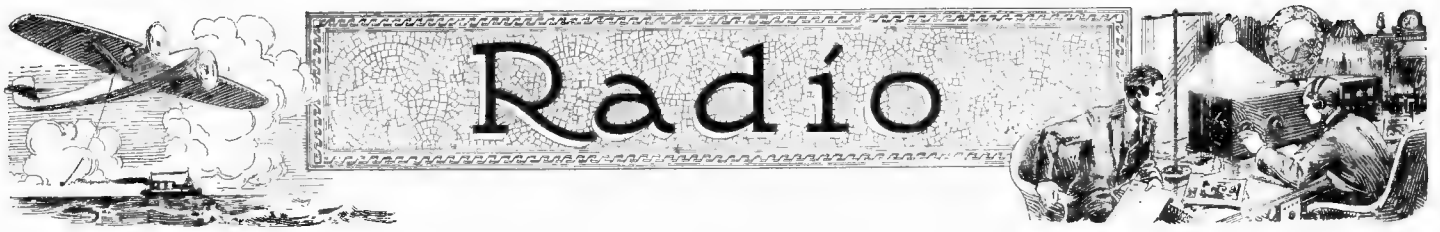
Testing for carbonates.



Testing for formalin.

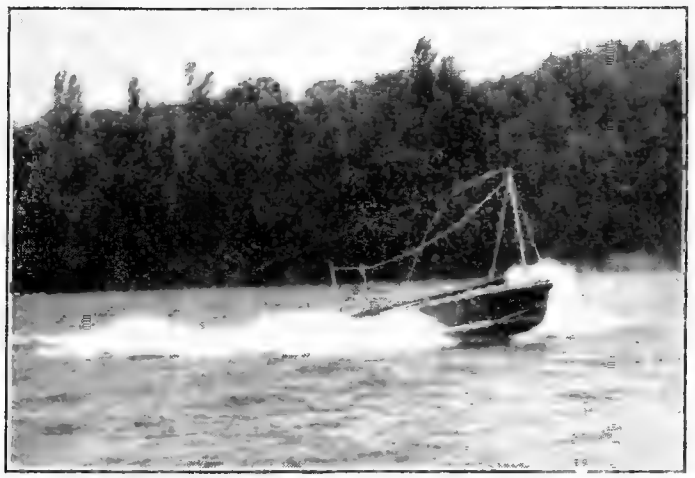


Testing for salicylic acid.



Radio Guides Torpedo Boat

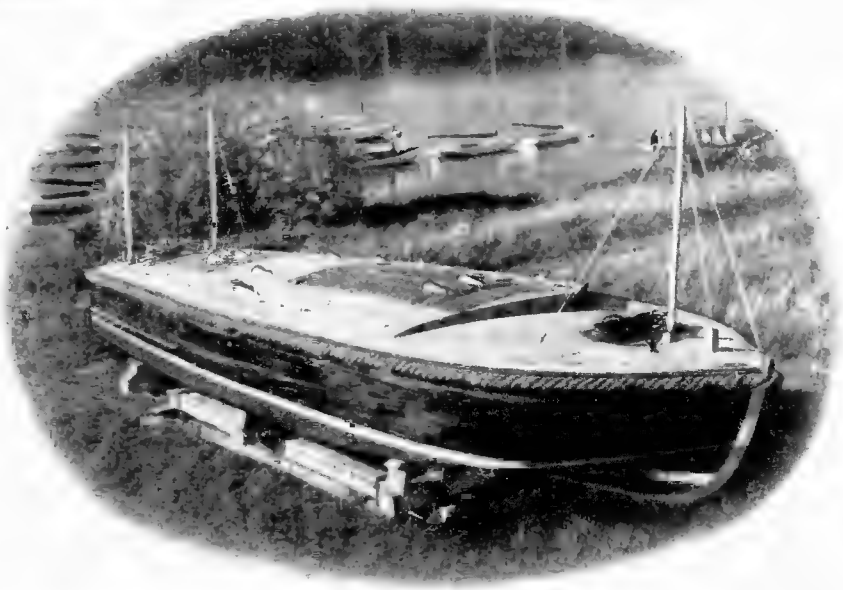
By LUCIEN FOURNIER



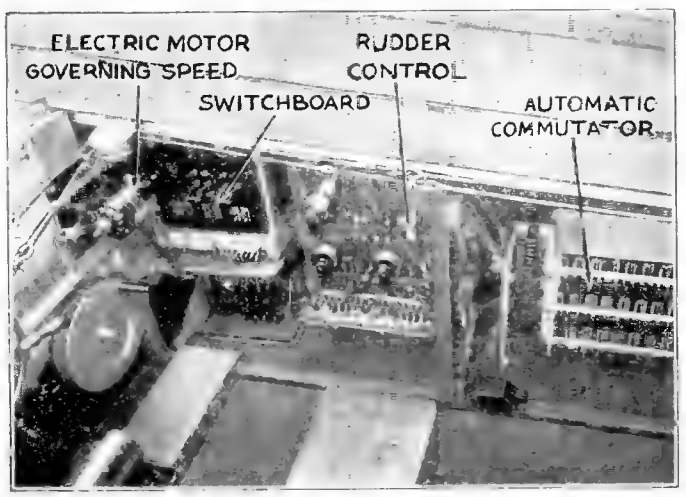
At the left we have a photograph of the scout boat on the Seine River, in France. The craft was controlled by radio entirely. Note the antenna strung above the boat for the reception of the controlling radio waves. The boat was guided without anyone on board.

Below is a photograph showing the boat on the bank of the river ready for launching. Some idea of its size may be obtained from this photograph. The antenna masts are shown clearly in this view. The aerial has not yet been put in place but is shown coiled on the deck.

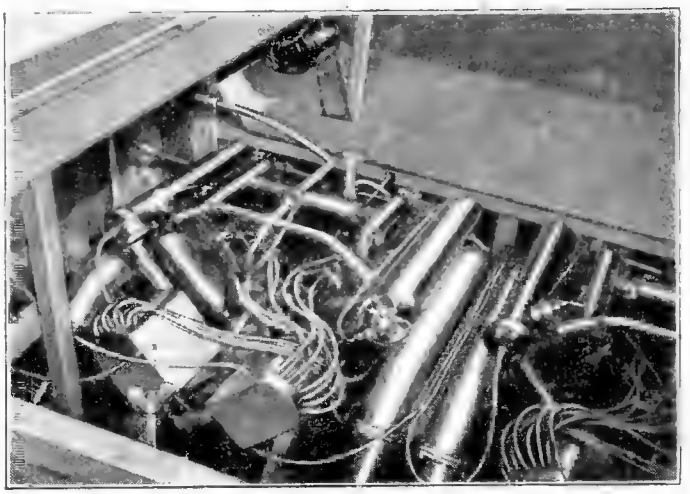
THE idea of controlling a boat entirely by radio is not a new one and has been tried out many times in the past. However, it is claimed that this is the first time that radio control has actually been proven to be successful, insofar as all the movements of the craft were under control at all times. Recently, on the Seine River, in Paris, a torpedo boat, shown in the accompanying photograph, was completely controlled from the transmitting station on the shore. An antenna was installed on the boat, and connected to a receiving set, which consisted of three stages of radio frequency and a special detector. Next to this was placed the remainder of the radio system. A special rectifier, following the radio receivers, supplied a direct current capable of operating a sensitive relay which closed the circuit upon reception of signals from the shore. All the apparatus was enclosed in a metal box or shield.



Along with this arrangement, which forms the radio electric equipment of the receiving set on the boat, various systems have been adapted to control the motors. For starting the motors, an apparatus is used which sends a charge of carbureted and compressed air into certain cylinders of each motor. This carbureted and compressed air is kept at a constant pressure of about 18 pounds by the action of a little compressing mechanism which starts automatically. The control is done by the operation of a relay which opens the valve and then operates a second relay which closes the "make and break circuits," and consequently explodes the mixture in the cylinders of the motor. The first relay is operated by sending signals which represent the command "forward." Commands "faster" and "slower" direct the speed of rotation of the motors. The radio signals also bring an electric motor into action which operates the choke valve of the carburetor, whose action is limited by contact. A projector sends a beam of light into the air and is operated by six impulses from the transmitter. Another motor is provided which steers the boat to the right or to the left. During war time, in order to

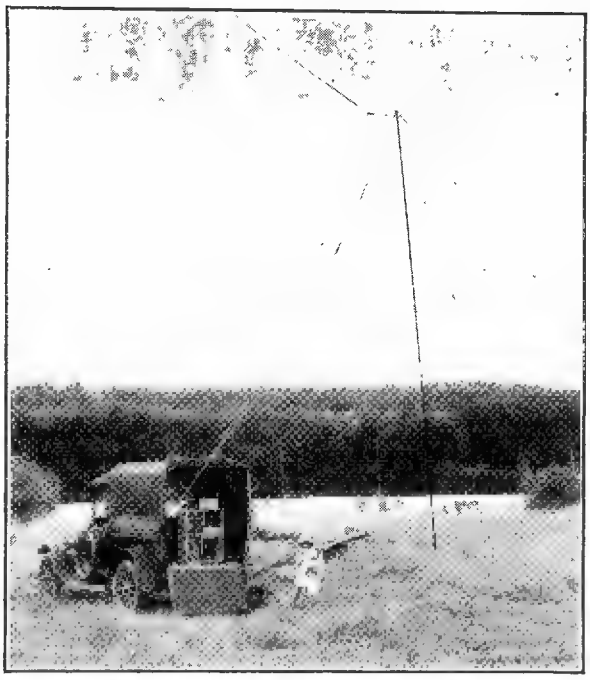


Above, the controlling apparatus is shown, and has been marked upon the photo.



Above, the 2 Hispano-Suiza motors of 180 H.P. each, for propelling the boat.

circumvent any subterfuge which may be used by the enemy, the radio command can be effected in two parts, which may be termed the "preparation" and the "execution." The "preparation" consists of a number of impulses separated by a certain degree of time. These may actuate relays and the like, and so prepare the receiving apparatus for the reception of the next signal giving the actual command. The action can then be stopped in the same manner. The signals, of course, can be made as varied as possible, using numerous combinations of dots and dashes and different intervals of time. In order to make the boat proceed at a certain angle, the radio operator can do this bit by bit, until the correct angle is reached, thus obtaining better control. The boat mentioned here was controlled by means of a portable radio transmitter installed in an automobile on the banks of the river. Both the transmitter and antenna may be seen in the photograph. The boat itself was propelled by two Hispano-Suiza motors of 180 horsepower each. These motors may be seen in the photograph appearing here. A view of the right side of the boat also appears and shows the grouping of the apparatus for controlling its movements. The electric motor governing the speed, the switchboard, rudder control and automatic commutator. The transmitter controlling the movements of the boat, operated on a wavelength of 300 to 500 meters. For operating the boat automatically during the night, a projector, consisting of a 300-watt lamp was installed in the bow of the boat, and was controlled by radio from the shore. In the interior of the boat were a number of storage batteries of 40 volts each, rated at 40-ampere hour capacity, and a 500-watt generator which was operated by the propelling motors. The boat was invented by M. Chauveau, engineer of the French Radio Electric Society, who has also devised a means of launching torpedoes from the boat by using the radio controlling system. The apparatus for complete radio control is of elaborate design, and even the smallest movement can be directed from the transmitter on shore. At a given signal, the boat starts, stops, reverses, turns around, or goes to the right or left, at the will of the radio operator. The pilot and the rest of the crew have been dispensed with, and we may see the use of radio-controlled boats in the next war.



Above is a view of the automobile radio transmission station which was erected on the edge of the Seine for controlling the movements of the boat.

Making a Remote Control Switch

By ELMER J. GARBELLA

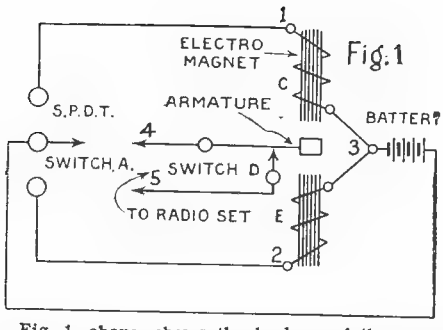
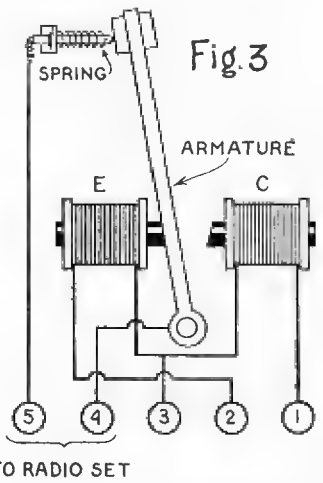
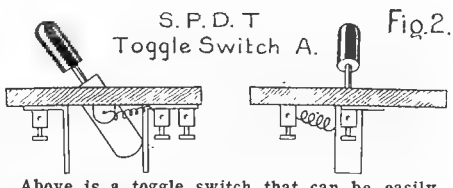


Fig. 1, above, shows the hook-up of the completed remote control switch described here.

THE contrivance shown here is not an absolute necessity, but the radio fan who likes to tune in a good program and then retire and listen in, will find that it makes things a great deal easier. It is rather irksome to have to get up and turn off the filament switch of the set in order to stop the radio. Fig. 1 shows the hook-up of the arrangement. Fig. 2 shows the construction of a small single-pole double-throw toggle switch, and Fig. 3 shows the electro-magnets which take care of the filament current switch. When, by means of the single-pole, double-throw switch, the battery current is sent through the electro-magnet E, the armature is pulled over so that a contact is made. When switch A is thrown to the opposite side, the battery current is sent through electro-magnet C, pulling the armature to the other side, thus breaking the contact. It will be seen that binding posts 4 and 5 form a single-pole, single-throw switch by using the armature. Furthermore, the toggle switch controls the armature, and therefore also controls the switching of posts 4 and 5. After looking over the diagram, the advantage of this arrangement can easily be seen. In the first place, the battery used to run the remote control switch is not used constantly since, as seen in Fig. 3, the armature is top heavy and after being pulled over by the magnet will remain in place, making good contact due to the spring, without further application of the current. Secondly, the electro-magnets can be located within the radio cabinet, and the filament switch is thus not far removed from the rest of the apparatus. Short leads are always desirable in a radio receiver and thus it is best to keep the filament switch within the set itself. Although the lines to switch A may cover a considerable distance, it will be noted that there is no steady current passing through them, as there would be if the filament switch were thus far removed. In Fig. 3, binding posts 4 and 5 are the only two which are connected to the radio receiver. Binding post No. 1 is connected to one end of the electro-magnet C and also to one of the poles on the single-pole, double-throw toggle switch. Binding post No. 2 is connected to one end of electro-magnet E and



The above illustration shows the two electro-magnets which take care of the filament current switch.



Above is a toggle switch that can be easily made by anyone. It is of the single-pole, double-throw type.

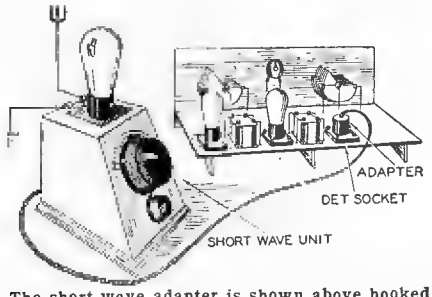
also to the other pole on the toggle switch. Binding post No. 3 connects to the other ends of the electro-magnets, and also to the "A" battery. The armature is connected to binding post No. 4 and the spring to binding post No. 5. The blade of the toggle switch is connected to the other side of the "A" battery. The toggle switch A can easily be made from two metal angles and a switch blade made from a piece of metal with an insulated knob, as shown in Fig. 2. The armature should be made from a piece of soft iron and weighted at the top, so that it will stay in position after being pulled over by the magnet. As will be seen, one end of the core of each of the electro-magnets is cut at an angle since the armature moves through an arc. Electro-magnets suitable for use in the remote control switch may be obtained from an old door bell. If none are available, they may be made by winding approximately 150 turns of No. 28 wire on a soft iron core about one-quarter inch in thickness and about an inch and one-half long. The diagrams and the accompanying text should make the construction of the remote control switch clear, and one should have no difficulty in making it. The switch should cost next to nothing, as most of the parts will be found in the experimenter's junk box, or can be made as described. The arrangement is simple in operation and only one connection is made to the radio set, namely, from the A-minus to post No. 4. The negative "A" battery terminal connects to No. 5.

NEW RADIO DEVICES

Accessories Recently Developed Which Will Improve Any Radio Set

SHORT-WAVE ADAPTER

A Milwaukee radio manufacturing company has recently brought out a short-wave unit or adapter which can be used with any receiver. No changes in wiring have to be made and all tuning is done with the one dial on the short-wave adapter. The detector tube is removed from the socket of the receiver and placed in the adapter. The short-wave unit plug is then fitted into the detector socket as shown in the illustration. The device is sensitive and capable of duplicating the results obtained with any short-wave receiver. The aerial and ground should be removed from the set and connected to the aerial and ground clips on the short-wave unit. This adapter works as a detector unit with all sets. The same instrument functions as an oscillator-detector unit with superheterodyne receivers, converting them into short-wave supers. The dials of the set have no effect in tuning when the short-wave unit is attached, therefore, they may be left at any setting. This unit is not available with interchangeable coils, but may be obtained with them on special order to cover other wavebands.

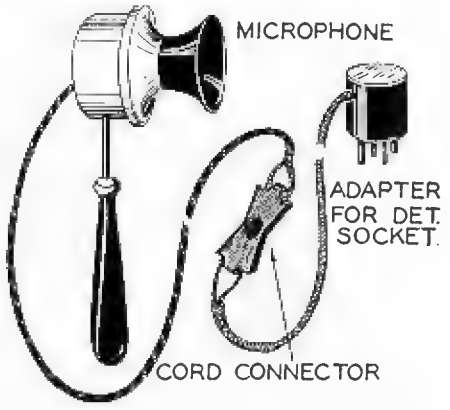


The short-wave adapter is shown above hooked to the receiving set. No changes in wiring are necessary, the unit simply being plugged into the detector socket.

Illustration courtesy J-M-P Mfg. Co.

HOME BROADCASTING OUTFIT

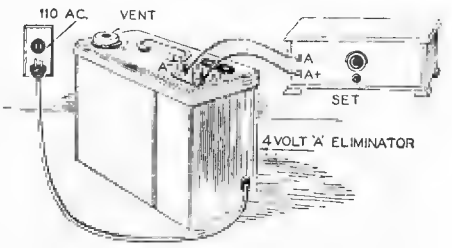
A home broadcasting unit for use with any receiver employing audio frequency amplification of some sort, has lately appeared on the market and is made by a Brooklyn manufacturer. The outfit consists of a microphone and a UX adapter for plugging into the detector socket of the receiver, so that the audio amplifier may be used to amplify any sounds which are picked up by the microphone. Long leads are provided, so that the microphone may be used in an adjoining room from the receiver.



The home broadcasting device is shown above and consists of a microphone and an adapter for the detector socket.

Illustration courtesy B-M-S Corp.

FOUR-VOLT "A" ELIMINATOR

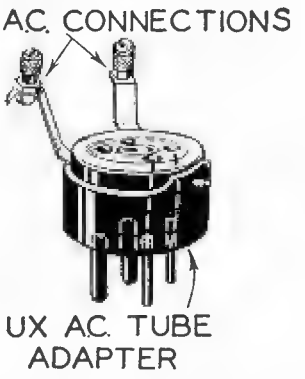


The four-volt "A" eliminator is shown above connected to a receiving set using 199-type tubes.

Illustration courtesy Abox. Co.

For those having receivers employing 199 tubes, a Chicago manufacturer has put a four-volt "A" eliminator on the market. The eliminator is enclosed in a green metal case and operates entirely without any objectional hum. An electrolytic rectifier and electrolytic condenser are used. In order to use the eliminator, it is only necessary to attach two wires from the A— and the A+ on the set, to the A— and the A+ on the eliminator, and then plug the unit into the 110-volt A.C. lighting socket. It is interesting to note that the plates for the electrolytic condenser and electrolytic rectifier are immersed in the same solution. A vent is provided at the top for the escape of any gas which may be generated while in use. A handle is provided for convenient carrying.

A.C. TUBE ADAPTER



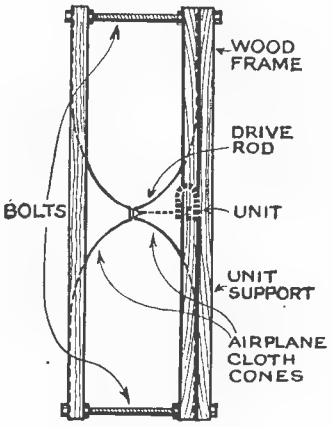
A new UX A.C. tube adapter is shown above. The A.C. connections are made to two lugs projecting from the sides.

Illustration courtesy Alden Mfg. Co.

Many have hesitated to employ the new A.C. tubes because their use would necessitate the change of wiring within the receiver. In order to make A.C. conversion simple, a prominent New England manufacturer has developed an A.C. adapter. The A.C. tube is plugged into the adapter, which, in turn, is plugged into the regular socket on the radio receiver. The two filament prongs on the adapter are "dummies," the A.C. connections being made to two lugs which project from the side. The grid and plate prongs connect directly to those on the ordinary socket. By using this adapter, it is not necessary to change the present filament wiring in the receiver, and the set may be readily converted to A.C. operation within a short time. The manufacturer makes a complete set of these adapters for any receiver.

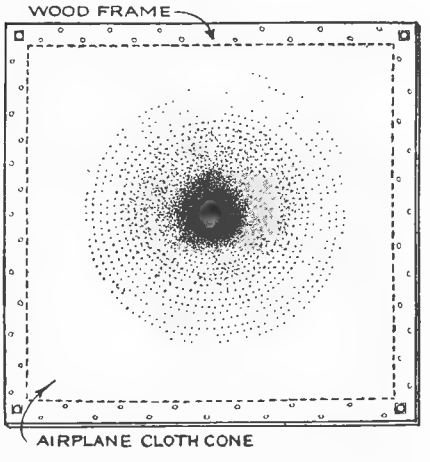
NOVEL CONE SPEAKER

One of the most unique speakers which we have seen in some time has been brought out by a New York manufacturer. Two large cloth cones made of airplane linen suitably "doped" are stretched upon a square wooden frame. Two of these frames are used and held together by four bolts, one at each corner. The cones are drawn in rather sharply at their mid portions. The unit is supported by wood cross-sticks and is placed as shown in the illustration. Excellent reproduction is obtained, especially on the low and high register. The drive rod is attached to the apex of each of the inverted cones. The illustrations shown here will give one an idea of the construction of this reproducer. The speaker will handle plenty of volume without distorting and will produce all programs with equal fidelity. Another distinct advantage seems to lie in the fact that the speaker tends to reproduce the low notes without a falling off of volume. The speaker is rather simple in design, is now available on the market and may be bought at quite a nominal cost. Although the speaker is rather large, it should look well in an ordinary sized room without being too conspicuous. There are many ways in which to camouflage the speaker, such as under a table, etc.



Above we have a side view of the speaker showing the placement of the unit and the two airplane linen cones.

Illustrations courtesy Air-Cone Studios, Inc.

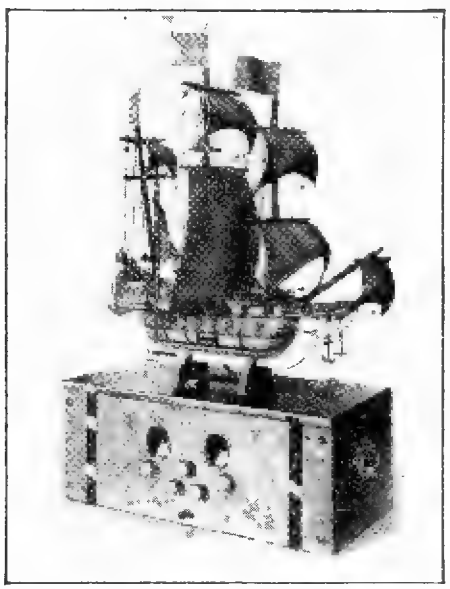


The front view of the speaker appears above. The linen cone is tacked upon a square wooden frame. A bolt at each corner holds the speaker together.

THE LABORATORY

A Receiver of Efficient Design

By PHILIP



A photograph of the completed super together with its loud speaker appears above. Note the artistic appearance which is afforded by the metal cabinet.

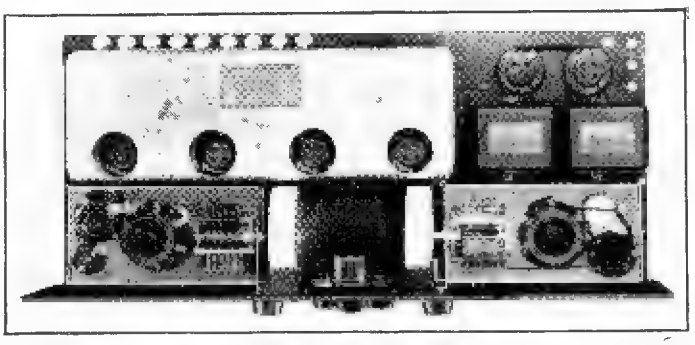
THE receiver shown on this page employs the superheterodyne circuit, acknowledged as the most sensitive and the most selective. The shielded super has great distance-getting ability and at the same time is very easily tuned. Probably the most important feature of this set is the handling of the intermediate frequency amplifier. Here use is made of a time-signal amplifier made particularly for the jewelry trade to receive time signals that are broadcast daily from Arlington, Station NAA. This unit consists of three stages of radio-frequency amplification and a detector, and is sharply tuned to Arlington wavelength, 112 K.C., so that only one station can be received at a time. This time-signal amplifier is completely wired in the factory, entirely shielded by individual stage compartments, enclosed in a brass and copper catacomb, and the whole unit tuned sharply to pass one band of frequencies only. This outstanding unit may be termed the backbone of the circuit.

LAYOUT OF PARTS

The detector and oscillator assemblies should be mounted upon the chassis inside the stage shield pans. The grid condenser and choke coil are also mounted in the detector assembly. The binding posts are mounted in the rear and the ground post grounds to the metal chassis. The four-tip jacks should then be mounted at the right rear of the base. The intermediate frequency amplifier is then mounted. The A— connection is automatically made to the amplifier through the contact between the amplifier shield and the metal chassis, no other A— connection need go to the long-wave amplifier. The two audio amplifier tube sockets should now be mounted, using their rear fastening screws as a means of connecting the F—posts to the chassis. The fastening screw of the ground post holds one end of the ½-mf. fixed condenser to the chassis. All possible wiring should be done now without proceeding further. Leave free the wire ends that will connect to the instruments on the front panel and to the two audio transformers. This is necessary, because if the audio transformers were mounted first, it would be impossible to make the connections to the output of the long-wave amplifier. After these connections are made, the audio-frequency transformers can be mounted and connected, then the front panel may be prepared. The potentiometer should be mounted as shown, using insulated washers to thoroughly insulate its frame from the panel. The rheostat and midget condensers are now placed upon the panel. The two drive mechanisms of the dials should now be fastened to the panel by means of the two brackets furnished with them. One variable condenser may now be fastened to either bracket. A drum should then be slipped over each condenser shaft. All wiring should be done with flexible hook-up wire. The connections to the condensers, rheostat, and potentiometer should be made before fastening the panel to the chassis. The on and off switch is mounted in the hole provided for it, and is thoroughly insulated from the panel and chassis.

WIRING THE RECEIVER

As mentioned before, all wiring should be done with flexible hook-up wire, and connections should be soldered to lugs or fastened under binding post screws where practical. After testing, all wiring may be bunched and laced into neat cables. However, there are two leads which especially should not be included in the cables. These are the wires running from the detector stage along the bottom of the chassis up to the oscillator coil. They should be well-isolated from all other wiring and run under the chassis separately.



Above is top view: Tops of the shields have been removed, showing the two tuning condensers and the antenna and oscillator couplers.
Photo courtesy Silver Marshall

OPERATION

With the "A" battery switch on, the rheostat should be turned almost to its full height position. Now if the potentiometer knob is turned to the right, a "plunk" should be heard at some point. This knob should always be operated just to the left of this "plunk" point. This adjustment should be made with the first detector tube out of its socket. The first detector tube should now be inserted and the midget condenser set with its plates all of the way out. The antenna coil rotor should now be set at a 45-degree angle and the oscillator rotor all the way in. A small antenna of 30 to 50 feet in length should be used. A larger one may be used if the set is not too near some powerful local station. Signals from weak stations may be intensified by turning up the regeneration condenser on the front panel.

ROTOR COIL ADJUSTMENTS

The position of the antenna coil rotor should generally be at about a 45-degree angle. With a small antenna, it may work best all in, with a large antenna at nearly right angles. The sharpness of tuning of the antenna dial depends upon the setting of this rotor, as well as that of the midget condenser. The oscillator rotor should be adjusted once on a very weak signal at about 300 to 350 meters, and once set for maximum volume, may be left alone.

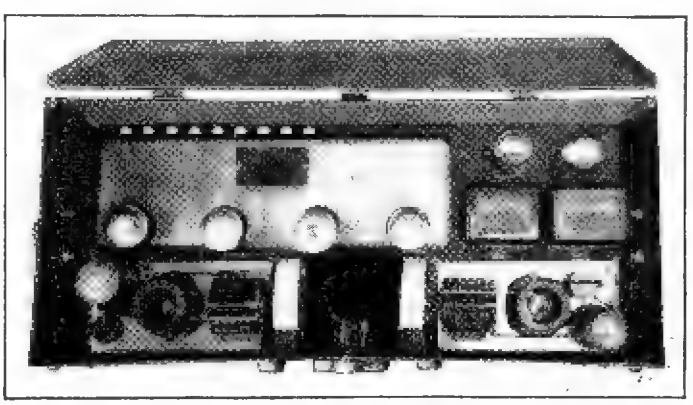
WAVELENGTH RANGES

The actual wavelength range of this super is from 30 to 3,000 meters. This range is covered by a set of five plug-in oscillator and antenna coils. On the shorter wavelengths, amateur and short-wave radio stations may be heard.

POWER AMPLIFICATION

It is highly desirable that an output transformer be used between the speaker and the receiver when a power tube is used. This unit has not been included in the set since the ideal way to build it is to leave out the second audio stage entirely and use a power amplifier of some kind. If this arrangement is used, both audio tubes and one audio transformer can be left out of the receiver proper, and the two output leads from this transformer secondary then lead to the power amplifier or power pack. There is room in the set for the incorporation of an output transformer.

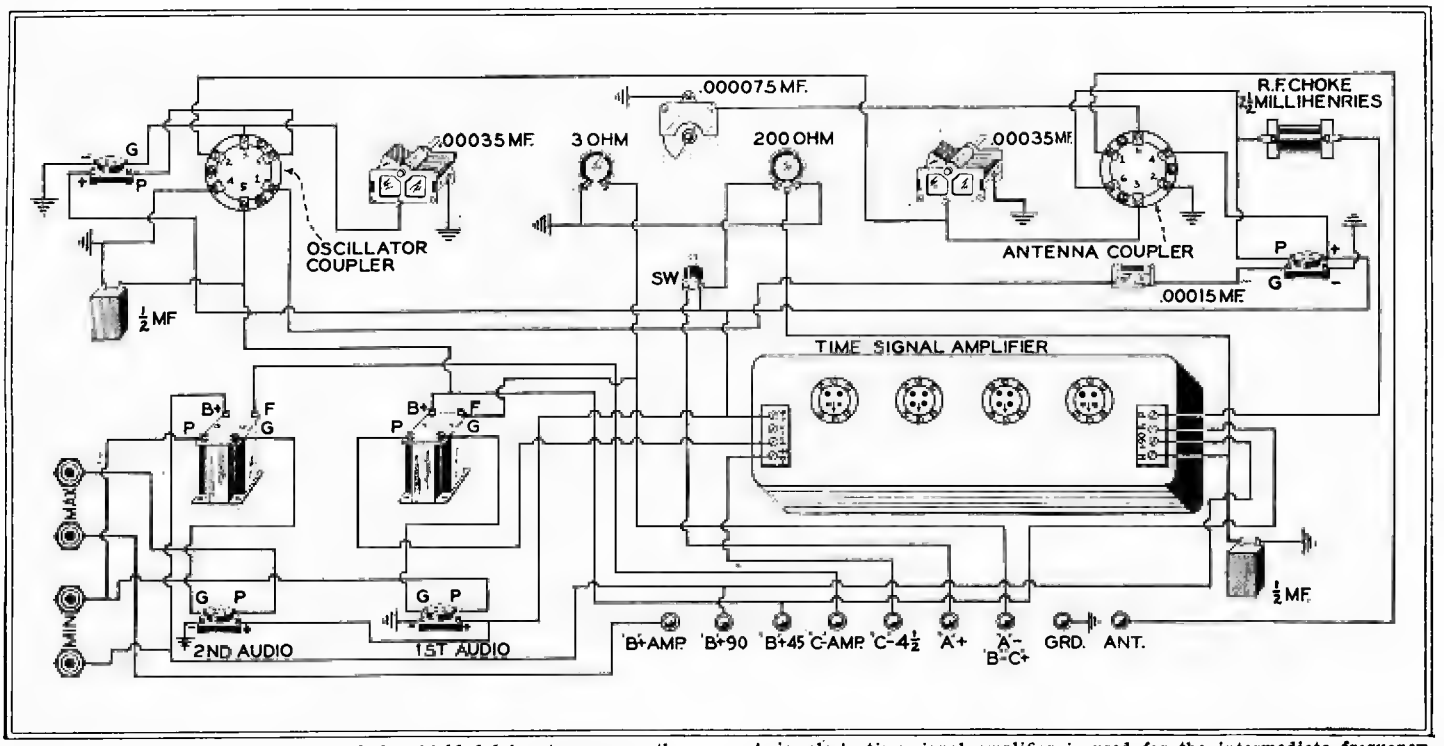
At the left is a bird's-eye view of the super with tubes in place. The time-signal amplifier is placed at the rear of the base to the left. The two audio transformers are mounted next to this. Nine binding posts have been placed along the rear edge of the base, in back of the time-signal amplifier. The two drum controls are used for tuning the oscillator- and antenna-coupler condensers. The midget condenser, three-ohm rheostat, and the potentiometer are placed between the two drum dials.



SHIELDED SUPER

Easily Built and Entirely Shielded

RADWELSKY



Above we have the picture diagram of the shielded laboratory super, the construction of which is described in the accompanying text.

A jeweler's time-signal amplifier is used for the intermediate frequency stages. It can be obtained completely assembled.

TUNING FOR DISTANT STATIONS

In tuning for distant stations, the two drum dials should be varied to receive a signal and the midget regeneration condenser set with the plates about one-quarter the way in. In order to cover the entire broadcast band, the antenna dial should be varied in steps of about one degree at a time, and for each of these one degree steps, the oscillator should be varied over a range of fifteen degrees above and below the antenna dial setting. Once a weak station is heard, it may be strengthened by turning the midget condenser further in and resetting the antenna dial slightly. If stations are heard on two or more points on the antenna dial, it is not the fault of the receiver, but is probably due to reradiation of transmitted signals from local steel structures and the like. The shielded super is extremely sensitive and is selective enough to allow reception of out of town stations, using a wavelength within seven to ten kilocycles of powerful local station waves. On short waves below 200 meters, the receiving range is unusual, and great distances may sometimes be covered. The two illuminated vernier drum dials do all the tuning, with three additional non-critical controls.

THE CABINET

The completed receiver may be housed within a metal cabinet such as that shown here or may be put in a console of a design and richness limited only by the owner's pocketbook.

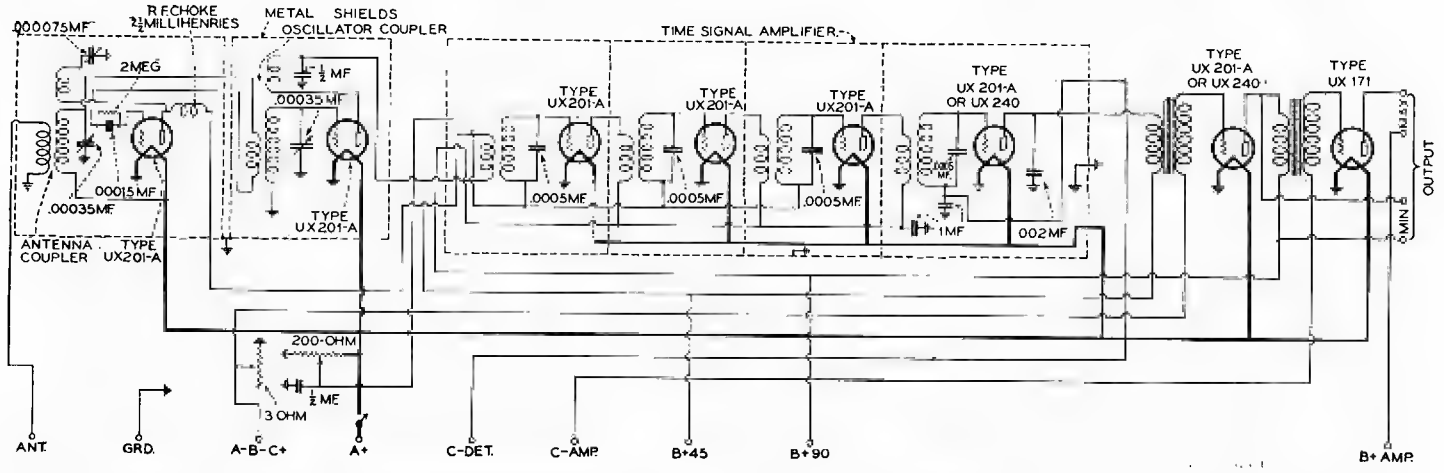
LIST OF PARTS

1 Metal panel and chassis unit or metal cabinet.
1 .00015-mf. grid condenser with grid leak clips.
1 200-ohm potentiometer.
2 ½-mf. by-pass condensers.
1 3-ohm rheostat.
1 battery switch.
4 tip jacks.
1 2-megohm grid leak.
2 audio-frequency transformers.
4 cushion sockets.
2 vernier drum dials.
1 2½-millihenry R.F. choke.
2 .00035-mf. variable condensers.
1 time-signal amplifier, or other intermediate amplifier peaked at 112 K.C.
2 plug-in coils with sockets.
9 binding posts.
1 midget condenser, maximum capacity .000075 mf.
2 stage shields

Names of manufacturers of parts furnished free upon request.

TOOL LIST

Pliers, several kinds.
Screw-drivers, several sizes.
Hammer, hacksaw and blades.
Hand drill. Electric soldering iron.
Twist drills, several sizes.



The schematic diagram showing the hook-up of parts is shown above. Both the oscillator and antenna couplers, together with their tubes and condensers, are enclosed in metal shields, as shown in the photos.

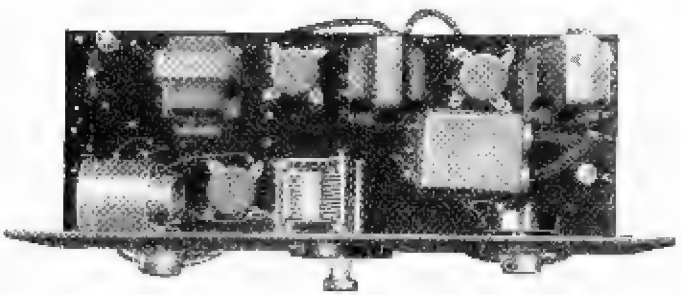
A radio-frequency choke of 2½ millihenries is connected in the plate circuit of the first detector. A power tube of the UX-171 type is used in the last audio stage, providing plenty of handling capacity.

S & I. 3-TUBE A.C.—D.C. SET

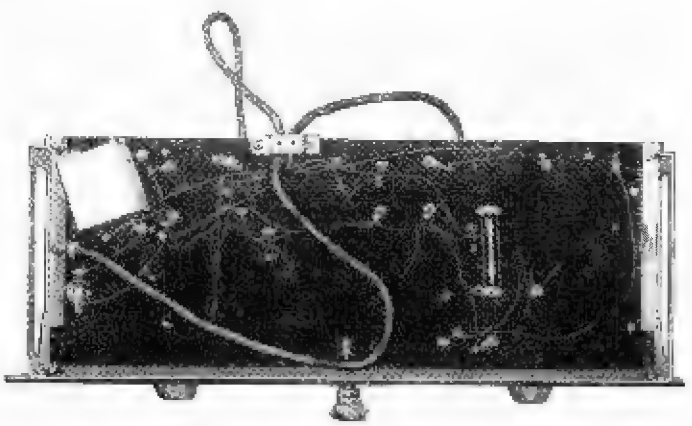
By PAUL WELKER

The Second Part of an Article Describing the Construction of a Versatile Receiver for Battery or A.C. Operation

How the Set Is Adapted for A.C. Tubes



Above is a photograph showing the layout of parts in the receiver. Note that the A.C. transformer has been placed on the right side of the sub-panel, away from the three-circuit tuner.



A bottom view of the set appears above, showing how the wires are brought out in cable form and the twisted pair leading up to the A.C. transformer.

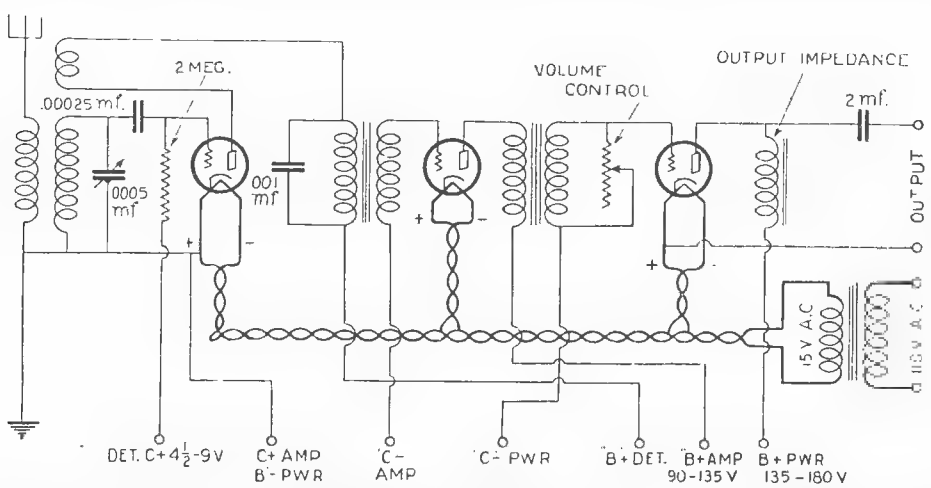
IT will be remembered by our readers that the first part of an article describing the construction of a receiver, for A.C. or battery operation appeared in the February issue of this magazine. This, the second part of the article, will deal with the conversion of the receiver for A.C. tube operation. By changing a few wires, the receiver is ready for use with A.C. tubes. The tubes used had a standard four-prong, UX base, and operated on 15 volts A.C., taking .35 amperes each. As the construction was completely described in the previous issue, it will not be dealt with here.

A.C. CONVERSION

First of all, the A.C. transformer should be mounted on the baseboard at the right, and kept away from the tuning coil and other apparatus, as far as possible. As the filament wiring has already been cabled, it is only necessary to attach the two leads which originally went to the "A" battery, to the secondary of the A.C. transformer. The grid leak connection will have to be modified somewhat, as shown in the accompanying diagram. One end connects directly to the grid of the tube and the other to the detector "C" battery, which provides a positive bias. The filament switch already installed on the panel may be replaced by a midget 110-volt power switch, which should be connected in series with the A.C. line. The present filament switch, if it is of good construction, may be used for this purpose, however. The C-plus amplifier and B-minus power are connected to the ground, as is the C-minus detector lead. Outside of the slight changes mentioned above, the circuit remains the same and can be easily converted for A.C. operation within a short time. A cable should preferably be used for the B and C leads, as there is less danger of getting these mixed.

The set usually works satisfactorily when using the light circuit as the antenna. This may be done by connecting a condenser having a capacity of about .002 mf. between one side of the lighting line and the aerial binding post on the receiver, the outside antenna being detached.

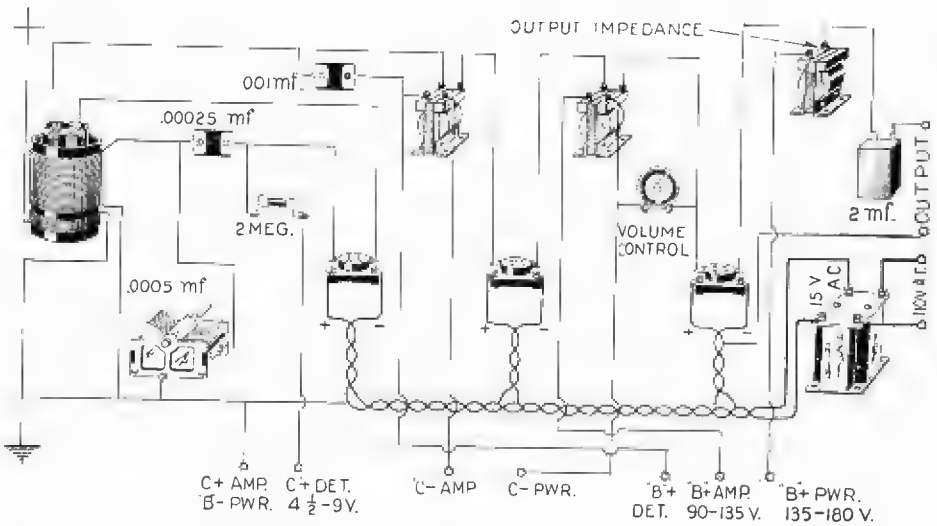
For those who have not built the D.C. receiver, it may be well to mention that a small three-circuit tuner was employed which will cover the broadcast wavelength band when tuned with a .0005-mf. variable condenser. Since a power tube is used in the last stage, in both the A.C. and the D.C. set, an output transformer or output impedance will have to be employed.



The schematic diagram of the 3-tube A.C. receiver appears above. The "C—" detector is connected to the "B—" power and "C+" amplifier, which ultimately go to the ground. Note that the connections of the grid leak are changed slightly and that one end of the leak is connected to the "C+," in order to obtain a positive bias for the detector tube.

LIST OF PARTS

1 small 3-circuit tuner
1 .0005-mf. variable condenser
3 cushion sockets
2 low-ratio audio-frequency transformers
1 output transformer or output impedance
1 zero to 500,000-ohm variable resistance
1 midget jack
1 power switch
3 A.C. tubes (detector, amplifier and power tube)
1 A.C. transformer for type tubes used
1 2-megohm grid leak
1 2-mf. speaker filter condenser (if output impedance is used)
1 .001-mf. and 1 .00025-mf. fixed condenser



Above we have a picture diagram of the receiver which is identical to the schematic, and has been printed here for the benefit of those who find difficulty in following the latter.

RADIO ORACLE

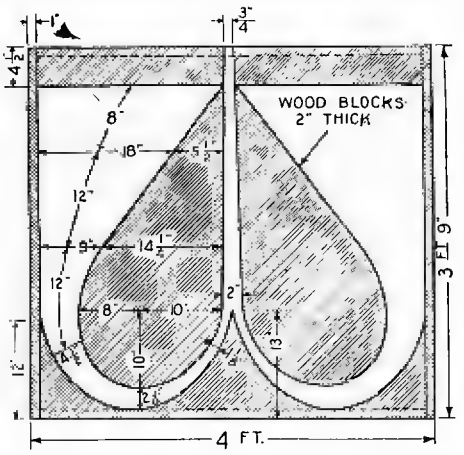
In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

EXPONENTIAL HORN

(609) A. V. Herbert, Hackensack, N. J., writes:

Q. 1. If possible, will you kindly illustrate in your columns, the construction of a folded exponential horn, similar to those developed by the American Telephone and Telegraph Company, having a cut-off frequency of about 64 cycles.

A. 1. On this page you will find illustrated the plans for this horn, showing the layout of the baseboard and central portion. All dimensions have been marked upon the illustration. The heaviest pieces of timber required are those for the heart-shaped blocks. Single blocks of timber of this size are usually not readily obtainable, and they will, in most cases, have to be built up from whatever wood is obtainable, the laminations being carefully glued and screwed together. The principal requirement is that the inner walls of the sound channels be as smooth and correctly shaped as possible. For this reason the use of hard wood is preferable, so that the inner walls can be polished after using a grain filler, thus making the air resistance of the surface as low as possible. Throughout the entire assembly



The above diagram gives the constructional details of an exponential horn 12 feet long, having a cut-off frequency of 64 cycles.

care should be taken to see that all parts are cut accurately, so that the shape of the sound channels will not be distorted and so that no cracks are left between the blocks. The unit itself is placed at the back of the horn. The completed horn is twelve feet long and has a mouth four feet square. The plywood sides should be screwed to the wooden blocks. During the final assembly all parts should be glued together, under pressure, as well as screwed, so that there will be no danger of them moving out of place. The mouth of the finished horn may be covered with wire gauze stretched over light grill work, or the whole speaker may be fitted into a console cabinet. Probably the best possible unit for use with an exponential horn is the moving coil type, especially for high-powered work; but the balanced armature type performs very well, and almost any kind of a unit will show an improvement in its performance when connected to a properly designed exponential horn.

GLOW TUBE CONNECTIONS

(610) H. Lambourne, Rochester, New York, writes:

Q. 1. Will you kindly tell me how I may connect a gas-filled glow tube to my present "B" eliminator?

A. 1. A tube of the type mentioned is designed as a voltage regulator for the 90-volt tap of the "B" eliminator. Besides keeping the voltage constant, it also assists in smoothing out the fluctuations in the rectified current. It acts as a shunt of negative resistance on the plate supply, taking more or less load automatically as the voltage tends to rise or fall from changes of the load in the plate supply circuit. The tube glows with an orange-colored light when in operation. Absence of this light indicates that it is not functioning, and, generally, that the "B" circuit has been overloaded or short-circuited; in this event the voltage impressed on the two terminals is below that necessary for the gaseous glow discharge. A standard socket is used, with the plate and grid connections left open. The negative filament post on the socket is connected to the negative terminal of the elimiator. When the open circuit or no-load voltage of the eliminator between the 90-volt positive terminal and negative terminal is above 100 volts and less than 130 volts, connect the 90-volt positive terminal of the eliminator to the filament plus on the socket. in the receiver. When the open circuit voltage is between 130 and 220 volts, insert in series with the glow tube a fixed resistor of 980 to 1,000 ohms between the 90-volt positive terminal of the eliminator and the filament plus terminal of the socket. When the open circuit voltage is less than 100 volts, no type of glow tube will function.

LACK OF SELECTIVITY

(611) C. L. Angstrom, Freeport, Ill., asks:

Q. 1. Briefly, what are the chief causes for lack of selectivity in the radio receiver?

A. 1. The chief causes for lack of selectivity may be divided into three main classes. The first class contains all the faults that introduce excessive resistance in the radio circuit. Reducing this resistance to the lowest possible value will not only increase the selectivity, but at the same time, will multiply the sensitivity and volume of the receiver. The second class of faults includes mistakes in coupling between the various circuits. Usually, loosening the coupling between any two of the radio-frequency circuits will increase the selectivity. Too loose a coupling will reduce the sensitivity of the receiver. The third class includes the faults of poor proportion between inductance and capacity in the tuned circuits and in the antenna circuit. Many non-selective receivers have too little inductance in their circuits. Increasing the ratio of inductance to capacity will improve the sensitivity and selectivity. The effect of shock excitation from nearby broadcasters whose signals tend to blanket all other reception may be greatly reduced by the use of proper shielding or by tuning the antenna circuit.

SHORT WAVE CONVERTER

(612) J. Rondeau, St. Louis, Mo., asks:

Q. 1. Will you kindly publish a diagram for a short-wave converter which I can use with my present 5-tube receiver. The short-wave coil secondary is tuned by a .00025-mf. variable condenser.

A. 1. For those who wish to explore the short-wave band from 15 to 125 meters, several ways are provided. However, most of them require the changing of connections of the present receiver over to a short-wave set. In order to eliminate this change, a short-wave converter may be built, the diagram of which appears upon this page. No change is necessary in the receiving set nor are any of the battery connections disturbed. To convert the receiver, it is only necessary to disconnect the aerial and ground wires and attach them to the short-wave converter. An adapter can be made from an old tube base and the wires marked P, A+ and A— connected to the corresponding prongs on the tube base. The detector tube should be removed from the receiver and placed in the converter. The plug from the converter is then fitted into the detector socket of the receiving set. The tuning is all done from the one dial on the converter. The tuning controls on the receiver are not used. The converter is really a short-wave set consisting of a regenerative detector and a simple plug for connecting to the audio end of the present receiver. Regeneration is controlled by a 0 to 500,000-ohm variable resistance connected across the plate and the tickler. A .00025-mf. condenser is used with a set of three short-wave coils. A vernier dial is necessary, as tuning will be very sharp. The choke coil is important and must not be omitted. When by-passed with a .002 condenser, it will permit the plate lead to be long enough to reach the receiver. If a choke coil cannot be easily secured, one can be made by winding 100 turns of No. 26 D.C.C. wire on a wooden spool one-half inch in diameter and with a one-quarter inch core.

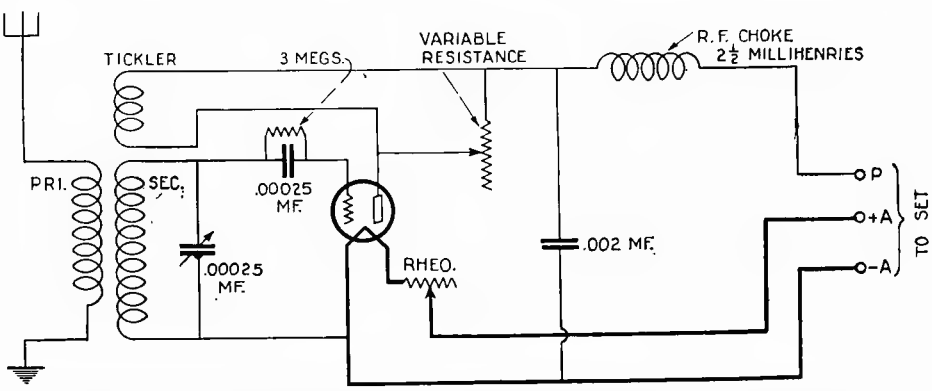
SHIELDING IN RADIO SETS

(613) E. R. Flynn, Rockville Center, L. I., N. Y., asks:

Q. 1. What is the advantage of using shields in radio receivers and what materials may be used for this purpose?

A. 1. Shielding has become popular with radio set builders. By the use of intelligent shielding, receivers can be made more sensitive than would otherwise be possible. Primarily, the advantage of shielding is to reduce the feed-back or to advance the point of self-oscillation so that increased amplification may be obtained. In this way, it is possible to make receivers far more sensitive and capable of receiving over greater distances. At present, shielding is the only reliable method of definitely limiting the extent of the external electro-magnetic and electro-static fields between coils. By using shielding and thus advancing the point of self-oscillation, it is possible to employ a greater number of radio-frequency stages without undue difficulty in preventing or controling self-oscillation. Grounded rotor variable condensers have made receivers free from body capacity effect, but in some receivers, especially on short wavelengths, this annoying action is still experienced. Thorough shielding will eliminate this trouble entirely. Changes in the field between the body and the interior of the receiver which may be caused by moving the hand or body toward or away from the panel will not influence tuning if shielding is used. A good conductor will dissipate stray charges or currents more easily than a poor one. Since copper has a low resistivity, it is a very efficient shield. Experiments have shown that strong magnetic fields will pass through very thin sheet metal. Any opening in the shield will entirely ruin the effect of the shielding material. Present day broadcasting, with its numerous and powerful stations, requires perfect magnetic insulation. In some cases aluminum plates have been used between adjacent radio-frequency stages, and while they serve the purpose fairly well, they do not provide the full insulation that complete box shields of aluminum or copper do. Brass may also be used for shielding, but is not as good as copper or aluminum. Iron or steel must never be used for shielding high-frequency currents or circuits. Iron and steel have a high resistance as compared with copper, and will not absorb readily the energy from field lines of force. Furthermore, iron and steel introduce magnetic effects and then have fields of their own which would make matters worse than ever. If audio frequencies are to be shielded, the shields will have to be thicker than those effective at radio frequencies. A thin shield is effective at high frequencies, because these short waves do not go through any shield as readily as the lower frequency waves. A thickness of metal, from No. 6 to No. 30 gauge may be used satisfactorily for shielding.

It is impossible to build a perfect shield because any metal used for this work will have some resistance and therefore could not absorb all of the radiated lines of force. The fewer the openings in the shield, the more effective it will be. All joints in the shield should be crimped and soldered their entire length. To prevent the passage of any lines of force into a shield, the wires may enter and leave through bent copper tubes. The extent of capacity effects between the shield, coils, wiring, condensers and the like within the shield is increased when any or all of these parts are placed close to the shield. So far as space limitations will allow, the shield should be kept at least two inches away from all shielded parts. The best results in the preventing of feed backs will be secured if the shields enclosing the radio-frequency stages are allowed to be insulated from all other circuits.



Above we have a schematic diagram of a short-wave converter which can be used in conjunction with any radio receiver. No changes are necessary in the receiver itself when this unit is used.

Scientific Humor

THE SPIRIT OF SCIENCE

A certain well-known expert in animal behavior has four children. He sends two of them to Sunday School every week and keeps the other two for controls.

—*R. W. Crosley.*

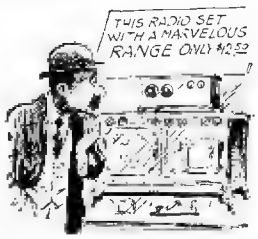
BRING A GUN

'Hello! Is this the Telephone Company? Could you send one of your trouble shooters out here right away?"

"What's the trouble?"

"My wife."—*John H. Spicer.*

A STOVE—A STOVE, MY KINGDOM . . .



Sign in radio and hardware store window:—"This radio set with a MARVELOUS RANGE only $12.50!"

THOUGHTFUL WINDOW-SHOPPER: — "If they let me get a look at the stove that goes with that radio, maybe I'd risk $12.50 on the both of them."—*William Lemkin.*

HOW THIS DRESSING (Distressing)

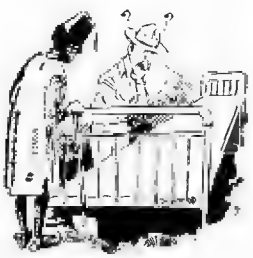
CUSTOMER: "I want a dress to put on around the house."

DUMB CLERK: "How big is the house, madam?"—*William Cook.*

WHEN SHORT CIRCUITS ARE GOOD

FIRST MILKMAN: "The battery in my car runs down about every day when I'm delivering milk."

SECOND MILKMAN: "That's because you have a short-circuit."—*Wm. G. Mortimer.*



SO IT IS

LECTURER: We dug up a bed in Egypt twelve by twenty-eight feet.

KID: That's a lot of bunk. — *Leslie Carpenter.*

SO WOULD YOU BE

FAIR PASSENGER: "Why is the ocean so restless?"

CAPTAIN: "Well, one could hardly expect it to rest easy with so many rocks and crabs in its bed."—*Mrs. Annie L. Bates.*

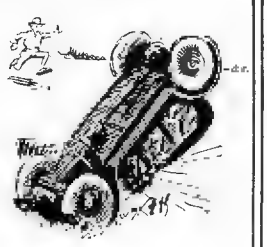
Q. E. D.
FIRST PRIZE—$3.00

"I heard Tom was hurt, how did it happen?"

"Well, do you see that ditch over there?"

"Yes."

"Well, he didn't."—*Luke Blanco.*



OH SINCLAIR

CHEMISTRY PROFESSOR: "Mr. Dunn, will you tell us about the composition of babbitt?"

UNPREPARED STUDENT: "I'm sorry, Professor, but I don't get time to read up on this modern literature."—*Gleason Pease.*

WHO PICKS THE FIVES?

JOHN (a new clerk in store): "You say these articles in this basket are five and ten cents. How can I tell them apart?"

MR. JONES (proprietor): "Oh, it's easy enough to do that. Whichever one the customer picks up is ten cents."

—*William Cook.*

ALL jokes published here are paid for at a rate of $1.00 *each;* $3.00 *is paid for the best joke submitted each month.*

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

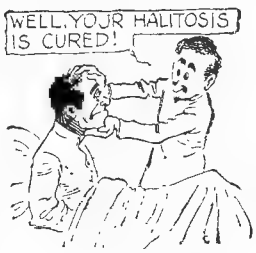
Unavailable material cannot be returned.

RAY-RAY

TEACHER: "What is an X-ray?" (ex-ray).

JOHNNY: "Oh, it's a kind of retired fish."

—*David R. Owen.*



USELESS INFORMATION

Lockjaw is a surer cure for halitosis than listerine! — *Henry A. Courtney.*

ON THE LEVEL?

HE: "I see they are going to make umbrellas square after this."

SHE: "What is the idea in making them square?"

HE: "Because it ain't safe to leave them 'round."—*Millard Stephenson.*

NO-RYE

TOM: "I've had an idea milling around in my head for some time now."

DON: "Huh! Aged in the wood, as it were."—*Jesslyn Hull.*

UNWOUND

"Doing anything for yourself since that car hit you?"

"I'm taking yeast for that 'run down' condition." — *H. P. Sedgwick.*

THE CAUSE

A chemist says that the first alcohol was distilled in Arabia, which may explain those nights.—*Mrs. C. W. Tilden.*

NOT ON TIME

PASSENGER: "When does the half-past five train leave?"

PORTER: "At five-thirty, suh."

PASSENGER: "Well, the City Hall clock is twenty-seven minutes past, my watch is twenty-five past, and your clock is thirty-two. Now, which one am I to go by?"

PORTER: "Well, suh, you all can go by any clock you please, but you can't go by that train, fo' it's gone."

—*R. Hadly Waters, Rep. No. 27,808.*

CROSSED CROSSINGS—GETS CROSS

"He speeded up, thinking he could beat the locomotive to it."

"Did he get across?"

"He will as soon as the tombstone maker has finished it."

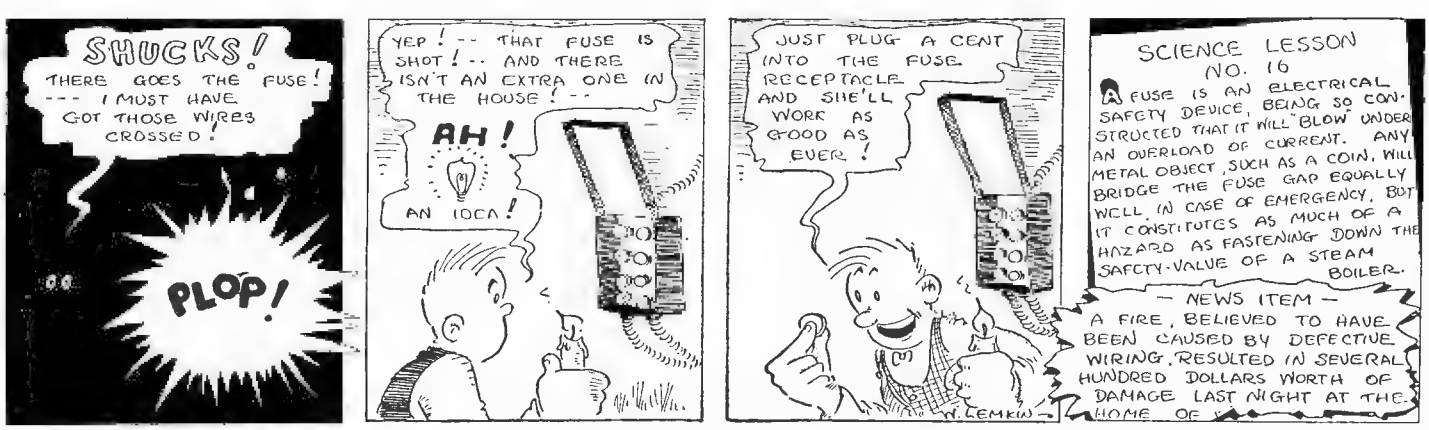
— *Earle Bennett.*

HARD BOILED

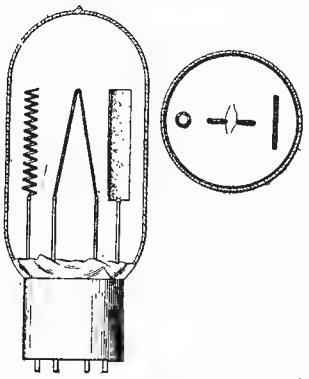
JIM: "He thinks he's tough—calls himself a hardboiled egg."

JACK: "And, as you might expect, he's yellow in the middle."—*Joseph Wallace.*

SCIENTY SIMON, Scientist

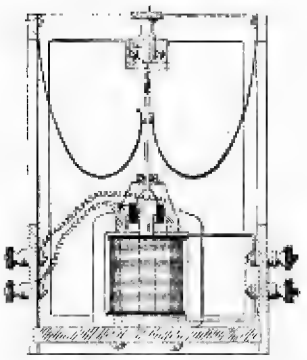

SHUCKS! THERE GOES THE FUSE! --- I MUST HAVE GOT THOSE WIRES CROSSED!
PLOP!
YEP! -- THAT FUSE IS SHOT! -- AND THERE ISN'T AN EXTRA ONE IN THE HOUSE! --
AH!
AN IDEA!
JUST PLUG A CENT INTO THE FUSE RECEPTACLE AND SHE'LL WORK AS GOOD AS EVER!
N. LEMKIN
SCIENCE LESSON NO. 16
A FUSE IS AN ELECTRICAL SAFETY DEVICE, BEING SO CONSTRUCTED THAT IT WILL "BLOW" UNDER AN OVERLOAD OF CURRENT. ANY METAL OBJECT, SUCH AS A COIN, WILL BRIDGE THE FUSE GAP EQUALLY WELL, IN CASE OF EMERGENCY, BUT IT CONSTITUTES AS MUCH OF A HAZARD AS FASTENING DOWN THE SAFETY-VALVE OF A STEAM BOILER.
— NEWS ITEM —
A FIRE, BELIEVED TO HAVE BEEN CAUSED BY DEFECTIVE WIRING, RESULTED IN SEVERAL HUNDRED DOLLARS WORTH OF DAMAGE LAST NIGHT AT THE HOME OF

VACUUM TUBE



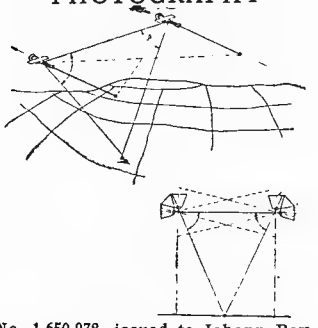
No. 1,650,921, issued to Louis Winkelmann. The invention shown here is a vacuum tube whose elements are coated with a combination radio active substance and phosphorous, or a substance similar to phosphorous.

LOUD SPEAKER



No. 1,638,245, issued to Charles Crawford Davis. The radio reproducer shown above consists of two diaphragms suspended from opposite ends of a support. All vibrations are reproduced truly, as there is no resonant frequency. The drive rod of the unit is connected to the ends of the diaphragms.

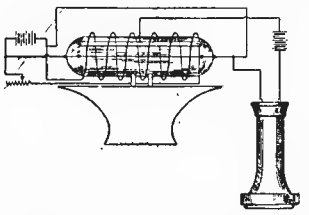
AERIAL SURVEYING BY PHOTOGRAPHY



No. 1,650,978, issued to Johann Boykow. This method of surveying consists in mountaing a camera on two airplanes and taking photographs of a common area to be surveyed, and a photo of the craft carrying the other camera. This last named airplane is also provided with a trailing rope of known length.

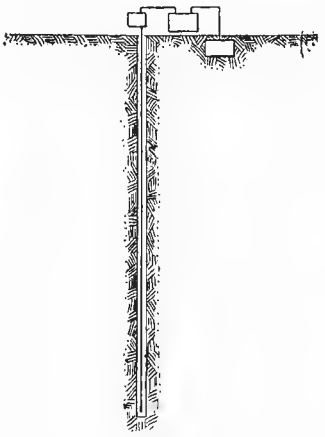
APPARATUS FOR ELECTRICALLY PRODUCING SOUND

No. 1,640,140, issued to Theodore Bodde. This device consists of an electron discharge device, which transforms sound waves or impulses into corresponding current pulsations by the action of an electron discharge tube.



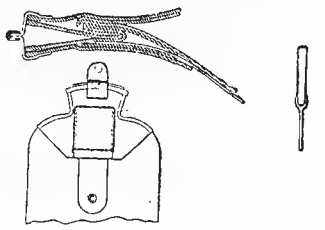
INVESTIGATING SUBTERRANEAN STRATA

No. 1,652,227, issued to Theodor Zuschlag. This method of investigating subterranean strata consists in placing an antenna in a drill hole, causing high frequency oscillations in the antenna and ascertaining the resistance characteristic of the antenna for each frequency employed, and so deducing the nature of the strata.

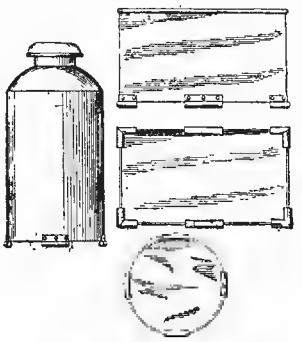


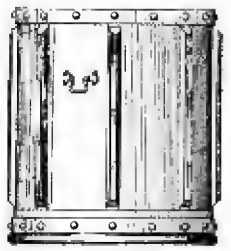
CLOSURE FOR WATER BAGS

No. 1,652,457, issued to Milton B. Beach. This invention consists of a liquid container having an elastic neck capable of being folded twice upon itself, and tension means permanently carried by the container for holding the folds under compression to make a liquid tight closure.



CAN



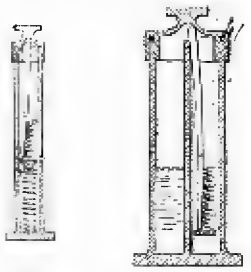


No. 1,651,552, issued to Louis Rosenberg. Two modifications of the can are shown above. A buffer for the bottom is provided which consists of a resilient element and a casing. The shock of dropping the receptacle is thus minimized. Provision is also made for longitudinal reenforcements on the sides.

AUTOMOBILE BUMPER

No. 1,647,627, issued to Samuel Horowitz. The bumper shown here has a number of independently operable units. Each of these units comprises a pair of corrugated members and has springs interposed between these members and the bumper units

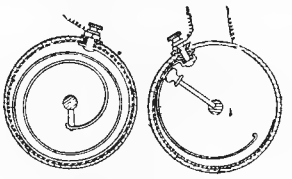
TOOTHBRUSH STERILIZER AND HOLDER

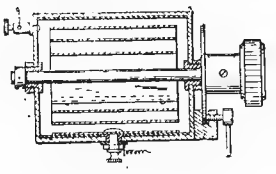


No. 1,562,348, issued to John W. Lockery. The individual toothbrush sterilizer and holder consists of two side by side compartments, one which holds the antiseptic solution and the other the toothbrush. Two variations are shown above.

VARIABLE CONDENSER

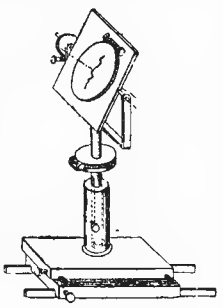
No. 1,652,158, issued to Wilson Aull, Jr. This invention relates to a variable condenser of small volume per unit capacity, as compared to other condensers in use today. The plates are separated by thin sheets of mica. The mica dielectric has a constant of four to eight times that of air.

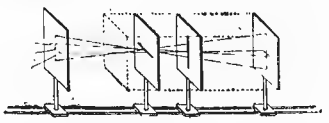




PRODUCING DISTORTED IMAGES

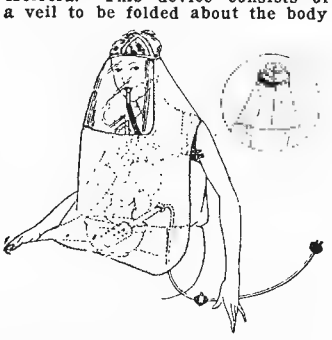
No. 1,652,271, issued to Hereward Lester Cooke. The invention relates to methods and means of producing distorted images in a pre-determined manner, and also provides for controlling the amount or direction of distortion so that the image may be caused to go through changes.





FACIAL STEAMING

No. 1,637,077, issued to Anna E. Herrera. This device consists of a veil to be folded about the body



and to cover the face. A breathing tube is also provided. All may be adjusted to various sizes.

NOTICE TO READERS: The above illustrated and described devices have recently been issued patent protection, but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses. —EDITOR.

The Oracle

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

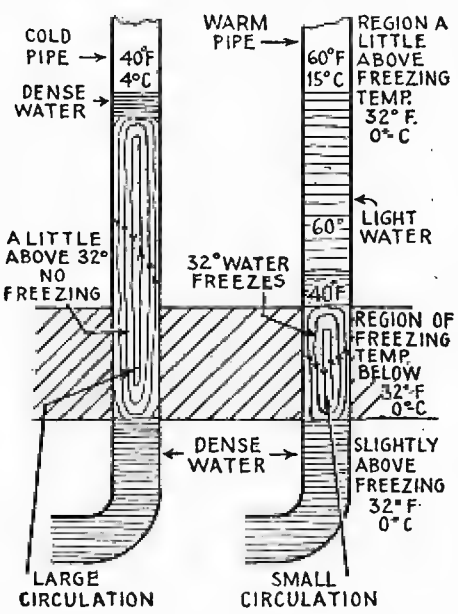
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

HOT AND COLD WATER FREEZING

(2237) T. Retsky, Hackensack, N. J., writes:

Q. 1. For several winters I and several of my neighbors have experienced trouble with the hot water pipes which have become frozen while the cold water did not. Can you tell me the cause of this strange occurrence?

A. 1. This is an ordinary occurrence, but it seems that there should be no reason why it should happen, as the hot water and cold water pipes usually parallel each other and are exposed to the same temperatures. The first experiment along this



The above illustration shows the circulation which takes place in a cold and warm water pipe.

line was conducted by Leon McCulloch research engineer of the Westinghouse Elec. & Mfg. Co. It is a well known fact that water is densest or heaviest a few degrees above freezing. On either side of this temperature which is 39 degrees F. the water is lighter. For example, at 44 Degrees F. 1 quart of water weighs 945 grams. At 39 degrees F. it weights 946 grams, while one quart of ice weighs only 887 grams. Thus water changes in weight only about one part in one thousand when its temperature drops from 39 to 32 degrees F. It is such a mobile fluid, however, that this small decrease in density is enough to set up a circulation by convection when the lighter 32 degree water is at the bottom of the vessel and the heavier 39 degree water is at the top. This denser 39 degree water starts to fall and the colder but lighter water rises out of the way. Thus a circulation is set up as the point of freezing is approached. The diagram on this page shows just how this is possible and will greatly help in explaining the curious phenomenon of the freezing hot water pipes. In a pipe which is kept cold, the point where the temperature is 39 degrees will naturally be found higher up, that is, further from the point of freezing, than will a similar point in the warm pipe. The amount of water kept in circulation in the cold pipe will thus be greater than the amount that circulates in the warm pipe. This circulation tends to keep the water at the bottom from freezing since the colder water rises and the warmer water falls. The actual water pipes in a house are not closed at the lower end, of course, but the conditions may be such that it amounts to the same thing. There is often a horizontal stretch or pipe, along a cold ceiling for example, just before the pipes pass a freezing cold space through a floor into a slightly warm room above. The horizontal pipe prevents convection and thus has the same effect practically as if the pipes were plugged at the bottom of the vertical portions. When a hot and a cold pipe pass up from a freezing region into a slightly warm room, the cold pipe may remain at about the 39 degree point, while the warm pipe, if slightly protected, may remain at a higher temperature long enough for the exposed portion to freeze solid. The cold water will be kept from freezing by the circulation.

VITAPHONE FADER

(2238) H. Quinn, Los Angeles, Calif., asks:

Q. 1. Can you tell me how the changes are made from one record to another in the Vitaphone, so that it is imperceptible to the audience and also how changes in intensity are produced.

A. 1. The Vitaphone provides for the reproduction of speech or music as an accompaniment to motion pictures. A large talking machine record is made to accompany the picture. This record turns more slowly than the records on the ordinary phonograph and is made large enough to play throughout a standard motion-picture reel. The needle running on the record drives a magnetophone pick-up device consisting of an armature moving in the field of an electromagnet whereby the vibrations which the needle receives from the record are produced electrically. A device known as the "Fader" plays an important part in this new process. It consists of a series of adjustable resistances, or attenuation networks through which the electrical currents from the magnetophone must pass before entering the amplifiers. The object of the Fader is to afford a means whereby a change may be made from one record to another. It also serves as a control device whereby changes may be made from one record to another. It also serves as a control device whereby changes in the intensity of the reproduced sound may be made as occasion requires.

EXPLOSIVES

(2239) P. Hamilton, Ft. Worth, Texas, asks:

Q. 1. Will you please give me the composition of brown powder and of cordite?

A. 1. Cocoa powder or brown powder is a variety of gun powder made with a brown charcoal prepared from straw. It consists of the following materials:

Potassium nitrate	79 parts
Sulphur	3 parts
Straw charcoal	18 parts

Cordite is the principle smokeless powder of the British services. It was originally adapted in 1888 and is made by mixing nitroglycerine with gun cotton and mineral jelly (a sort of crude vaseline), and incorporating them together with the aid of acetone, which gelatinizes the gun cotton. The formula for the explosive mixture is as follows:

Gun cotton	65 parts
Nitroglycerine	30 parts
Mineral jelly	5 parts

During the World War a further variety was introduced, which contains nitro-cotton of comparatively low nitration that can be gelatinized by means of ether and alcohol. This mixture contains the following ingredients:

Nitro cotton	52 parts
Nitroglycerine	42 parts
Mineral jelly	6 parts

THE GEOPHONE

(2240) A. H. New, Meriden, Conn., asks:

Q. 1. Will you kindly give me some information concerning the instrument known as the geophone and something of its uses?

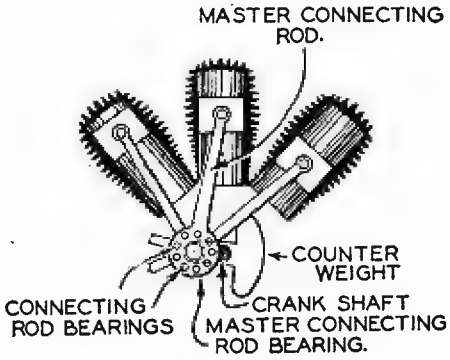
A. 1. The geophone is a sound ranging instrument invented by the French during the war. The form of the instrument was developed by the U .S. Army engineers and the U. S. Bureau of Standards, later the U. S. Bureau of Mines increased its sensitivity. In principle the geophone is a seismograph which is entirely mechanical in its action. It consists of a flat iron ring about 3½" in diameter and ½" in thickness, in the center of which is suspended a lead weight fastened with a single bolt through two metal diaphragms. One of these diaphragms covers the bottom of the ring and the other, the top. There are also two brass cap pieces, the top one having an opening in its center to which is fastened a rubber tube leading to a stethoscopic earpiece. If the instrument is placed firmly on the ground, and if there is any pounding or digging near it, the case of the instrument will vibrate with the earth. The lead weight, however, because of its mass will remain comparatively motionless, since it is suspended between the elastic diaphragms. Thus a relative motion between the diaphragms and the case is produced. This motion alternately compresses and rarifies the air in the spaces between the cap pieces and the diaphragm. The air waves thus set up are then transmitted to the observer's ear by means of the rubber tubing and the earpieces. The small enclosed air space in the bottom of the instrument between the plates and the diaphragm serves to dampen the vibration of the diaphragm. It is customary to use the geophone in pairs connecting one instrument to each ear. In the first instruments, the diaphragms were made of mica. It has been shown, however, that metal diaphragms are more sensitive and durable. A nickel diaphragm of .025 inch in thickness, is perhaps the best. The thickness of the diaphragm is apparently limited by the ability of the enclosed bottom air pocket to prevent undue vibration.

RADIAL MOTORS

(2241) R. E. Foster, Russell, Ont., Canada, asks:

Q. 1. Will you please describe how the connecting rods are fixed about the crank shaft in a nine cylinder, air cooled, airplane motor?

A. 1. On this page you will find an illustration which shows clearly the construction of the type of motor mentioned above. Eight small connecting rods are fastened to a large master connecting rod which is made in one piece. The master connecting rod is shown in the topmost cylinder in the illustration. It is wider than the other connecting rods but is of the same length. All nine connecting rods are held to the crank shaft by means of a master connecting rod bearing. A short stroke and large bore are used in this type of motor. This unusual arrangement is balanced by means of two counter weights which are placed as shown in the illustration. This is the principle used in practically all present day radial motors.



The illustration above shows the construction of a radial motor having nine cylinders.

WHITEWASH FORMULA

(2242) B. Brown, Vaux Hall, New Jersey, askes: Will you publish in the Oracle a formula for whitewash?

A. 1. We are giving below a formula which is used by the U. S. Government in making whitewash for light houses and other public buildings.

Unslaked Lime	2 pecks
Common Salt	1 peck
Rice Flour	3 pounds
Whiting	½ pound
Glue	1 pound

Water, a sufficient quantity.

Slake the lime in a vessel of about ten gallons capacity, cover it, strain, and add the salt which has previously been dissolved in warm water. Boil the rice flour in water; soak the glue in water and dissolve on a water bath, and add both, together with the whiting and five gallons of hot water to the mixture, stirring all well together. Cover to protect from dirt, and let it stand for a few days, when it will be ready for use. It is to be applied hot, and for that reason should be used from a kettle placed over a fire.

The whitewash may be colored by adding a small quantity of ocher, chrome yellow, Dutch pink, raw sienna, for yellows and buff. Venetian red, burnt sienna, Indian red, or purple brown for reds; celestial blue, ultramarine, indigo for blues. Red and blue are mixed for purple, gray or lavender; red lead and chrome for orange; Brunswick green for greens.

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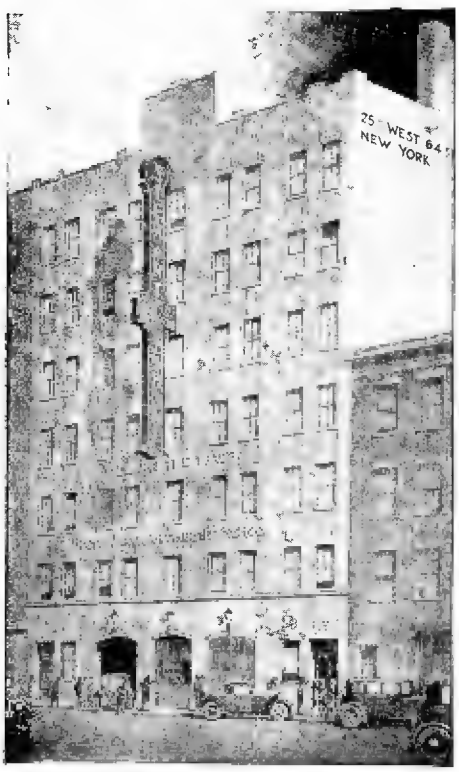

Completed May, 1927

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WHAT MAKES AN AUTOMOTIVE MECHANIC?

By HENRY TOWNSEND

(*Continued from page* 991)

garage apprentice has the ambition to study some of the theory books on engines, electrical ignition and lighting systems of cars, he will learn practically nothing of the theory in his three to four years' apprenticeship. Compare this for the moment with the graduate of a modern auto trade school where competent instructors first teach the students, and then give them daily and weekly quizzes in order to ascertain whether the student has actually mastered the technical details, whether it be theory or practice. Naturally the longer a man practises the more rapid and efficient he becomes, and as a director of one of the leading automotive trade schools pointed out to the writer, some of the students remain in the school for one to two months longer, in order to obtain more actual practice in the service department of this institution.

Of course many people will raise the objection against a trade school that the student is quite likely to receive too much theory and not enough practice—for it is well to remember that a man does not learn to use wrenches, electric drills and other shop tools simply from reading a few nicely bound textbooks. Thus it was a very agreeable surprise to the author upon visiting one of the leading New York automotive trade schools, that he found dozens of students busily engaged in actually assembling and disassembling well-known makes of cars, all under the direction of their instructors.

Let us consider for a moment a very interesting comparison between the subjects mastered by the average apprentice in a garage and a properly taught auto school student. How many of the garage mechanics you meet in your travels can answer "yes" as to their ability to properly perform the following work:—Diagnose various ills of the ignition system and make the necessary repairs; weld a motor car frame or properly straighten an axle; explain how any one of twenty different makes of carburetors perform, and be able to diagnose quickly just what is wrong with the carburetor on a customer's car; if, in fact, the trouble is with the carburetor at all.

What we wish to point out to aspiring automotive experts and mechanics is not primarily the fact that one can, in a modern automotive trade school, become a mechanic capable of earning a salary of $40 to $50, a week in a period of three to six months; whereas a garage apprentice will have to serve at least three years' time in order to command the same wages; but the much more important fact that the graduate of a first-class trade school has a very fine training in both theory and practice. The mechanic taught by the school knows just what is going on in any part of the motor car machinery, whether it be engine, carburetor, ignition, lighting, or differential gear.

Just to give an example from everyday life, it cost the author of this article nearly the original price of a car in one year, simply to keep it in repair. What do you think the true answer to this state of affairs is? He can tell you truthfully that there is only one answer, and although this case occurred several years ago, there is no change in the writer's mind as to the blame for such a garage bill in a twelve month period—the answer is *incompetence.*

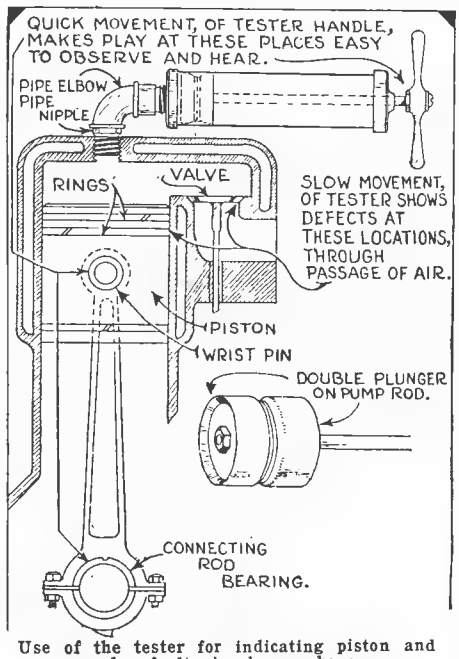
A further extension of the analysis shows beyond a shadow of a doubt that if properly trained automotive mechanics had done the work on the car in question, the monthly garage repair bills would have been not more than twenty-five per cent of the amount that they finally totaled. When the garage mechanic has to replace an engine fly wheel three times in three months, due to the teeth being knocked out of the fly wheel, because the starter-motor pinion had the wrong number of teeth on it, there is something radically wrong in the training of the mechanic who handled this job.

Today, as never before, industry everywhere and particularly the automotive field, demands men who know both practice and theory, especially when it comes to the servicing of 22,000,000 motor vehicles now owned and operated by the American public.

MOTOR HINTS

Conducted by GEORGE A. LUERS

(*Continued from page* 1004)


QUICK MOVEMENT, OF TESTER HANDLE, MAKES PLAY AT THESE PLACES EASY TO OBSERVE AND HEAR.
PIPE ELBOW
PIPE NIPPLE
RINGS
VALVE
SLOW MOVEMENT, OF TESTER SHOWS DEFECTS AT THESE LOCATIONS, THROUGH PASSAGE OF AIR.
PISTON
WRIST PIN
DOUBLE PLUNGER ON PUMP ROD.
CONNECTING ROD BEARING.

Use of the tester for indicating piston and valve faults is shown above.

More difficult than usual, is the job of holding a connecting rod cap or a steering gear or radius rod ball socket cap. If two bolts with double nuts, are arranged on the bench as shown, these caps can be held so as not to move while filing faces for adjustment.

TESTER FOR PISTON AND VALVE TROUBLES

The tester is made from a single cylinder tire pump, in which an extra leather plunger is inserted on the pump rod, in a reversed position.

The bottom of the pump is cut off and fitted with a ⅜ inch pipe nipple. A ⅜ inch elbow is used to connect this to a special nipple made with one end to fit the spark plug hole.

The nipple and elbow are screwed into the engine and the pump is then screwed to these.

By quickly moving the pump plunger in and out, lost motion in wrist pin or connecting rod bearing can be detected. A steady pressure on the pump plunger will indicate by air leakage, if rings, piston or valves are broken loose or leaking. It is advisable in making tests to have the engine crankcase removed.

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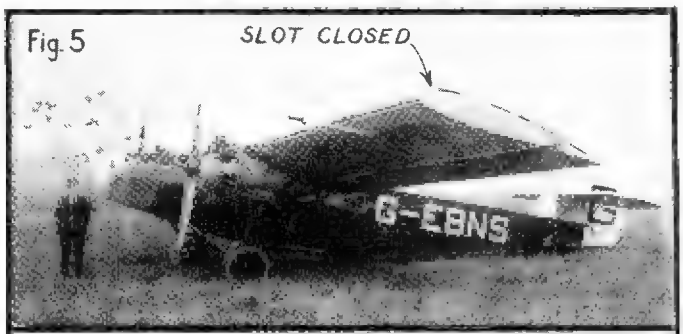
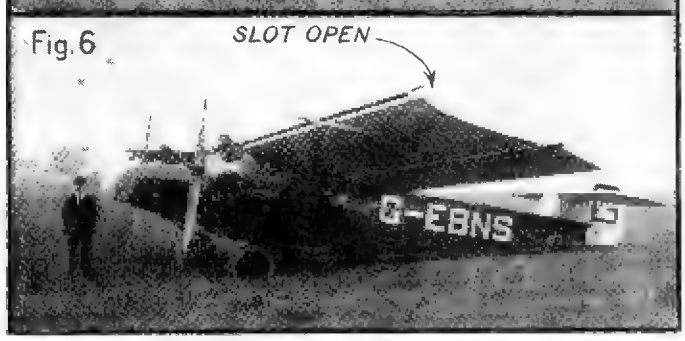
ELIMINATING FATAL "TAIL SPIN"

By C. A. OLDROYD

(*Continued from page 990*)

Two photos at right show Handley Page wing slot open and closed. This simple device will eliminate 85 per cent of tail-spins, it is claimed.





has experimented with airplanes fitted with slotted wings. An experimental machine is illustrated in Figs. 5 and 6. Here is the auxiliary plane, which, provided with the slot, was actuated by the pilot through a control gear.

The experience gained in these tests led to the latest truly revolutionary development, the *automatic stabilizer*.

Fig. 7 shows an airplane fitted with this device; narrow auxiliary planes are hinged to the leading edge of the wing. But these auxiliary planes do not reach from one end of the wing to the other; a short plane is fitted at each side, near the wing tip.

HOW WING SLOT WORKS

The action of these auxiliary planes is illustrated in the diagram (Figs. 8-10). In Fig. 8, the wing is shown inclined at a

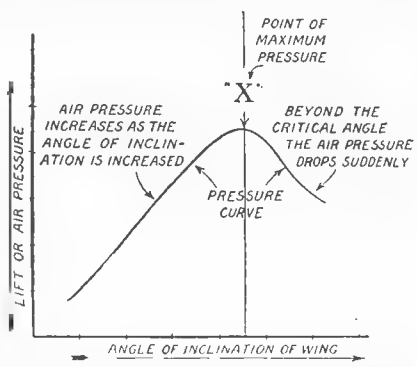

POINT OF MAXIMUM PRESSURE
"X"
AIR PRESSURE INCREASES AS THE ANGLE OF INCLINATION IS INCREASED
BEYOND THE CRITICAL ANGLE THE AIR PRESSURE DROPS SUDDENLY
PRESSURE CURVE
LIFT OR AIR PRESSURE
ANGLE OF INCLINATION OF WING

Fig. 2. This chart shows the relation of the various forces acting on an airplane in flight.

normal flying angle, the flow of air past the wing section is even and orderly, and in this condition, the auxiliary planes lie up against the leading edge of the wing, blending into its outline.

In Fig. 9, we have the same machine on the point of stalling. The air flow has become disturbed. As soon as this condition appears, the small auxiliary planes come into action.

TAIL SPIN STOPPED

Automatically, they swing out on their hinges and assume the position shown in Fig. 10, thus providing a narrow slot between the main wing and the auxiliary planes. Air rushes through this slot, establishing once more an even flow of air in the region of the wing ends.

This action of the auxiliary planes holds the airplane on an even keel, *even when stalled*, the nose of the machine dips slightly, and flying speed is automatically regained.

One might say that the hands of an invisible giant grasp the wing tips of the airplane, thus making an incipient spin impossible.

The Handley Page stabilizer is the result of many years' strenuous experimental work, and aeronautical experts agree that it is the greatest advance in heavier-than-air machine design the world has seen for many years.

All new machines of the British Air Force will be fitted with the new stabilizer; and at the time of writing, experiments are proceeding in London, England, to determine the best way of using the stabilizer on the English airliners plying between London and French, Dutch and German airports.

THE FUTURE OF TRANS-ATLANTIC FLIGHT

WILLIAM SULLIVAN

Aeronautical Engineer and Specialist in Design of Modern Airplanes and Dirigibles

will discuss a new way to solve the problem of trans-oceanic flying in the APRIL number.

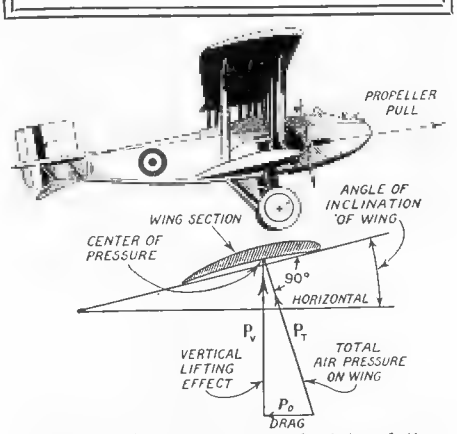


Fig. 1. In this figure we see the interrelation of forces from propeller pull, wing pressure, vertical lifting effect, and the drag.

New Apparatus for Retinal Examination

(*Continued from page* 995)

return through the pupil, again to the convex mirror, which gives a reversed clear image of the retina. This image is studied by the observer through the eye-piece as said image falls upon the plane mirror. The retina is seen four and one-half times magnified. If greater magnification is desired, additional lenses can be screwed into the eye-piece giving seven to ten times the magnification. At one end of the apparatus there is an eye screen to cover the eye of the patient, and at the other an adjustable eye-piece for the observer.—Contributed by Dr. Albert Neuberger.

Strange Hobbies and Crafts of Successful Men

BY GEORGE H. DACY

(*Continued from page* 993)

the A, B, C's of furniture making and ornamental whittling. He brought home unmerchantable and broken pieces of hardwood lumber from his yard and converted them into handsome book shelves, chairs, tables, book-ends and other household articles.

CHIP CARVING AN INTERESTING PURSUIT

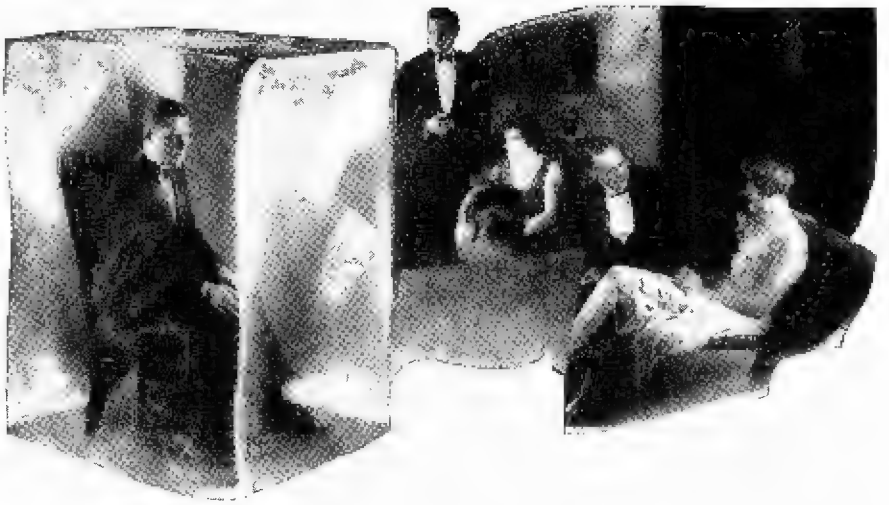
The art of Norwegian spot cutting or chip carving has come to America from the Northern Scandinavian countries. Centuries ago, the art came into being among the peasants of Norway and Sweden who spent the long winter evenings beside their hearths carving tough wood with razor-edged tools. One of Stockholm's finest exhibits of to-day is a collection of this wood carving of the seventeenth century.

Oak and walnut are the best woods now available for chip carving activities, although yellow pine, birch, mahogany, hickory and ash are also used. The wood carver first makes his book rack, tabouret, foot rest, panel, picture frame or—what not. Then he draws an appropriate geometrical design on the article and finally carves or chips out this ornamental pattern. Fancy initials and ornamental scrollery, such as one commonly sees worked into brass or other metals, may be as satisfactorily carved in hardwood.

Hand-carved costumers, wall seats, consoles, night stands, serving tables, pedestals, bud vases and candlesticks are commonplace in the Scheve home. They represent the efficiently utilized leisure of a successful lumberman. His attractive house is overflowing with the products of his handicraft. It would cost more than $2500 to purchase hand-carved articles like those that adorn this home. The experience of Mr. Scheve is that a man can enjoy a hobby, reap diversion from its practice and still make the pastime a profitable form of recreation.

Glenn Warner in charge of athletics at Leland Stanford University, California, is one of America's famous football coaches. For many years, he trained the former Carlisle Indian School elevens and later was head coach at Cornell University and subsequently served the University of Pittsburgh in similar capacity.

When Mr. Warner is not busy with athletics, you will find him in his workshop designing and making golf clubs or else out on the links testing the products of his amateur handicraft. This man Warner has originated many new types and styles of clubs. He has tested out many varieties of wood. Some of his finest club heads are made from a bed of beech wood in which the gridiron mentor slept for many years. He has also found that fish pole bamboo can be used satisfactorily as shafts in both wooden and iron-headed clubs.



I Turned To Ice When I Tried To Talk

—But Now I Can Sway An Audience of Thousands!

I HAD always been painfully bashful. When trying to carry on even the most commonplace conversation my voice would sound unnatural and my hands and knees would tremble. Often I would listen to an argument among a group and become so keenly interested that I would want to voice my own opinion—yet timidity would keep me silent. I never had the courage to stand up for what I knew to be my rights — I was always afraid of "what people will say," ridicule. Since my childhood I had had a secret desire to appear in public—to be active in politics—but my shyness was so great that I turned to ice when I tried to talk—in even the smallest gathering!

What 20 Minutes a Day Will Show You

- How to address business meetings
- How to propose and respond to toasts
- How to make a political speech
- How to tell entertaining stories
- How to write better letters
- How to enlarge your vocabulary
- How to develop self-confidence
- How to acquire a winning personality
- How to strengthen your will-power
- How to be the master of any situation

My inability to talk was also affecting my business success. I dreaded going in and asking for a raise—I was afraid of any situation that meant using my voice—having to express myself. I didn't know how to present the ideas which I was sure the firm could use. I was just a plodder—a truck horse, capable of doing a lot of heavy work but of no use where brilliant performance was required. Often I would see men who were not half so thorough nor so hard working as I, promoted to positions where they made a brilliant showing—not through hard work, but through their ability to talk cleverly and convincingly—to give the appearance of being efficient and skillful.

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And then suddenly I discovered a new easy method which made me a forceful speaker almost overnight. I learned how to dominate one man or an audience of thousands—how to say just the right words at just the right time, how to win and hold the attention of those around me, how to express my thoughts simply and clearly, yet in a pleasing, interesting and amusing way. In just a few months I was able to make campaign speeches for a local candidate—I who a short time before had turned to ice when I tried to carry on an ordinary conversation!

Soon I had won salary increases, promotion, popularity, power. Today I always have a ready flow of speech at my command. I am able to rise to any occasion, to meet any emergency with just the right words, to approach all types of people with ease and fearlessness. And I accomplished all this by developing the natural power of speech possessed by everyone, but cultivated by so few—by simply spending 20 minutes a day in my own home on this most fascinating subject.

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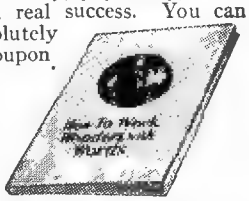
This new method of training is fully described in a very interesting and informative booklet which is now being sent to everyone mailing the coupon below. This book is called, *How To Work Wonders With Words*. In it you are shown how to conquer stage fright, self-consciousness, timidity, bashfulness, and fear—those things that keep you silent while men of lesser ability get what they want by the sheer power of convincing speech. Not only men who have made millions, but thousands have sent for this book—and are unstinting in their praise of it. You are told how to bring out and develop your priceless "hidden knack"—the natural gift within you—which will win for you advancement in position and salary, popularity, social standing, power and real success. You can obtain your copy absolutely free by sending the coupon.



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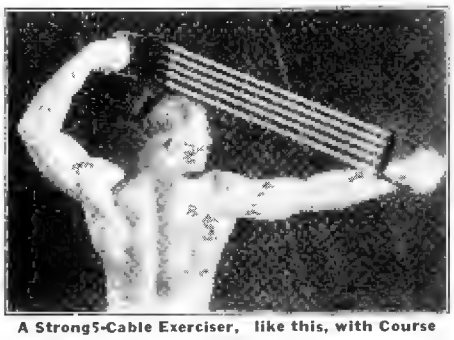

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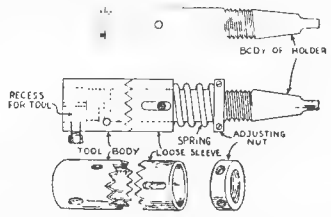
Hints for the Mechanic

TOOL HOLDER

FIRST PRIZE—$10.00

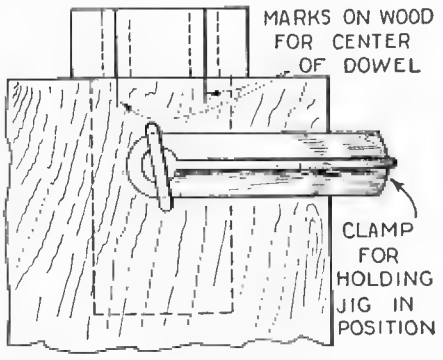
A special tool holder is shown in the above sketch. The body of the holder is made with the usual tapered shank. It has an adjustable nut which forces a heavy spring into contact with a loose sleeve. The sleeve is prevented from turning by means of a pin in the body of the holder.—*G. A. Luers.*



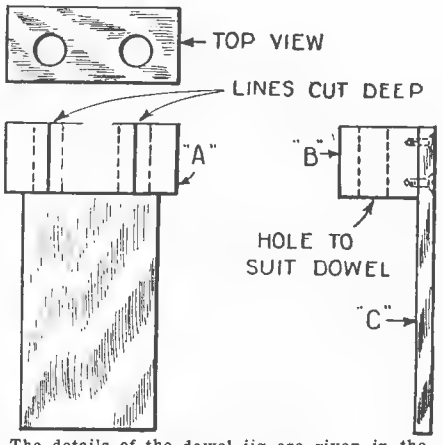
Details of the tool holder are shown above.

DOWEL JIG

The dowel jig shown here is made from a piece of square cold rolled steel, about two and one-half inches long. This is piece A. The back, C, is another piece of steel about four or five inches long, which is attached to block A. The illustration shows how the jig is used. It can be made in various sizes. —*Wm. A. Kyle.*

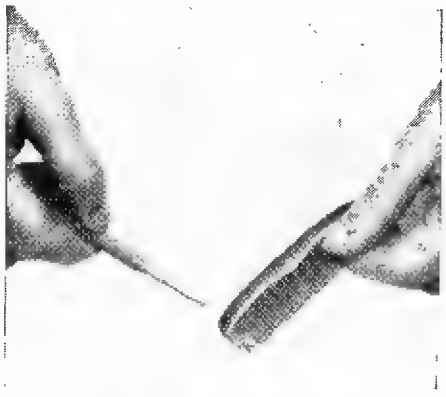


The use of the dowel jig is shown above. The device is very handy and is quite accurate.



The details of the dowel jig are given in the above drawing.

HOLDING SMALL SCREWS



A practical method for holding small screws is shown above.

Small screws may be held securely, so that they may be put in place, by sticking the screw between the teeth of a small comb. In this way it can always be held in a satisfactory position.—*Frank W. Bentley, Jr.*

MINIATURE CITIES—HOW BUILT

By LEE BLACK

(*Continued from page* 997)

from a few hundred dollars to many thousands for a single composition. If properly made and simple precautions are observed to protect the subjects against the elements, they can be preserved for hundreds of years.

HOW A "MODEL" SOLD FIG ORCHARDS

In the accomanying illustration a well known western land development company shows how it resorted to the use of a miniature to solve a perplexing problem of transportation and sales. This concern had developed a vast amount of acreage into fig orchards. The land was several hundred miles from the home office and the time and expense required to transport prospective purchasers of land presented an enigma.

A decision was made to have a full section of the land modeled, faithfully portraying the stage of development, the facilities and general environment, such as proximity to railroad, source of water and electric power, method of irrigation, accessibility of nearest town, etc.

The writer selects this as one of many he has built because of the wide diversity in the subject-matter and because of the difficulty of obtaining proper data.

PAPIER-MACHE MOUNTAINS

The mountains in the background were modeled in papier-mache and plaster composition, the elevations and physical forms being determined by means of reference to contour maps of the section. A waterfall (which is not visible in the photo) leads naturally, through mountain rivers to the dam which is visible with the lake just back of it. Since no blue-prints of the dam were available it had to be fabricated by calculation and recourse to many photographs taken from various angles at the actual site.

The large white building in the middle distance is the hotel on the main street of the town adjoining the property owned by the developers. The original is of stucco and the miniature is of wood construction, over which a plastic paint of a true stucco texture is applied with a brush and a small flat tool, which produces the same effect as the trowel in actual practice.

The original of the railroad station at the left was stuccoed by the pressure-hose methods so that in the construction of the miniature it was necessary to apply the plastic paint mixture with a small air-brush.

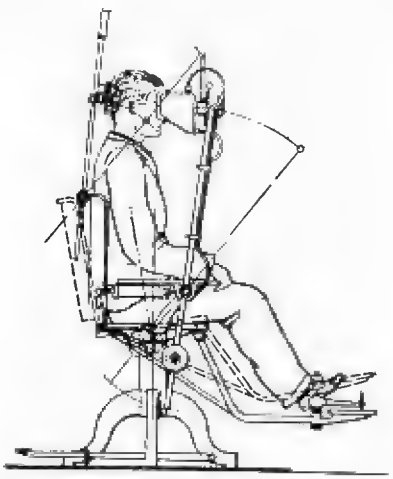
(*Continued on page* 1036)

Flying Blind

By G. K. SPENCER

(*Continued from page* 982)

volved. The pilots were shown on the ground, in a few simple experiments, how their *flying sense* could lead them to death.



The improved pilot test chair, fitted with eye-shield and apparatus for determining pilot's ability to fly by instruments only.

The instruction was so vivid that every man not only eagerly agreed to use the Ocker-Myers system, but in a few days none would fly without it.

FIRST SUCCESSFUL FOG LANDING

Air Mail Pilot J. L. Rutledge was the first pilot to land entirely by *instrument flying.* He recently brought down a fully laden air-mail plane in a fog, which offered no ceiling. That is, the mist extended down to the ground, allowing no visibility whatever.

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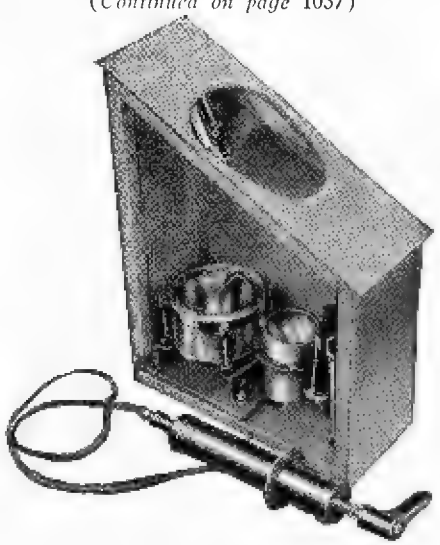
(*Continued on page* 1037)



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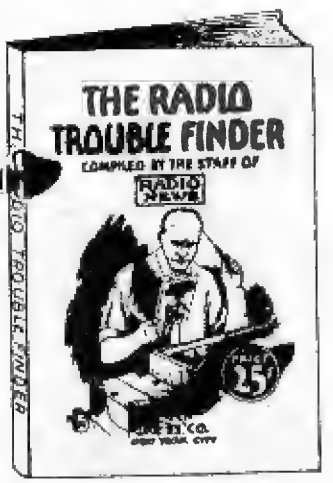

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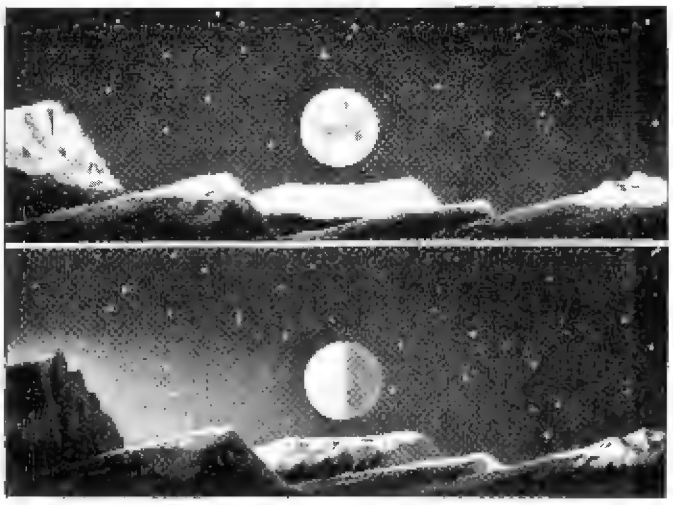
VISITING OTHER PLANETS

By JAMES NEVIN MILLER

(*Continued from page 998*)



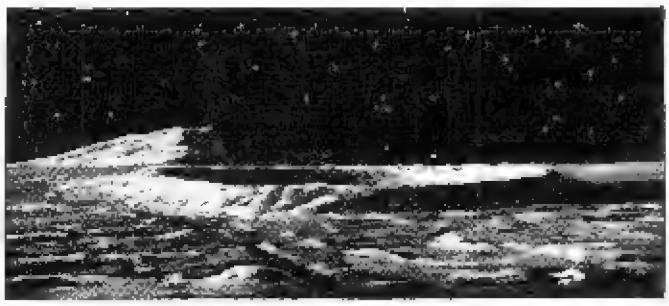
The illustration here shows the earth and its phases as seen from the southern polar regions of the moon. Top — full earth; bottom — last quarter.

TERRIFIC HEAT ON MERCURY

Journeying next to the planet, Mercury, closest to the Sun of the starry bodies, the astronomer who set foot on this planet, doubtless would momentarily forget his scientific observations in the face of a terrible heat. Indeed, it is doubtful if he could survive under it, for he could not possibly avoid it without travelling to the opposite hemisphere.

What manner of landscape is lighted by this colossal furnace? Unfortunately, but little is known of the mysterious planet in this respect, though it is probable that its surface is covered with high mountains. As for its atmosphere, that, too, has not been detected by the astronomers. Some astronomers believe the atmosphere is exceedingly rich in water vapor, and others that it contains none at all.

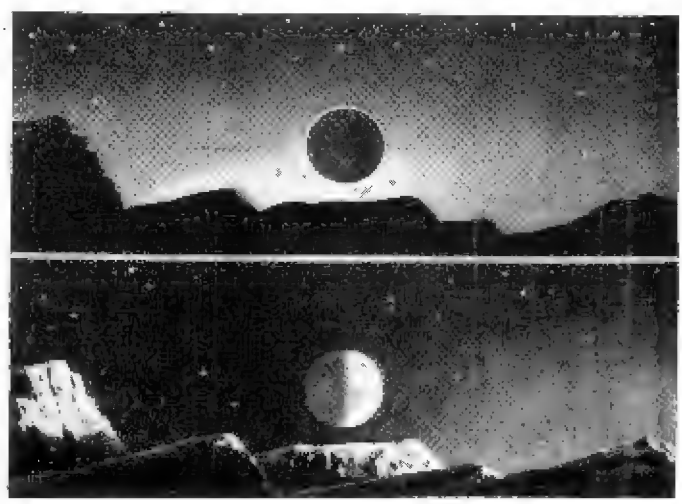
"At any rate, the density of its atmosphere is very great, almost double that of ours. Upon the surface of Venus, covered with this dense atmosphere, diffusing the intense light from the enormous sun as seen from there, a sort of luminous and troubled fog must singularly limit the range of vision,



At the left is shown a view of a typical small lunar crater. Note the peculiar formation of the substance forming its outer edge.

VENUS COMES TO VIEW

Seen from Mercury, the planet, Venus, which is farther off from the sun, would, at certain times, appear to be a truly blinding star. Here again, science knows but little. The body appears to have a brilliant whiteness, but none of its details may be detected because its thick, cloudy atmosphere hides its surface from the eyes of man, however aided by scientific instruments. doubtless preventing the enjoyment of any extended landscape. What are these landscapes? In lieu of anything better, let us suppose there exists here a surface, with some land but much water. Through the dense atmosphere, the stars are either slightly or not at all visible. If the sun can be observed at setting, the phenomena of refraction will be noted as on earth but will be very much more in evidence, modify-



Here we see the earth and its phases as viewed from the southern polar regions of the moon. Although the earth appears at rest in the sky, the sun moves along horizontally beneath the horizon, hid by the mountains, whose summits are illuminated by it. Top—earth surrounded by its brilliant atmospheric ring. Bottom — last quarter.

ing strangely the appearance of the solar disk."

WE LAND ON MARS

Arriving next at Mars, farther away from the sun than the earth, the traveller should feel much more at home, for atmospheric conditions are quite familiar. Even day and night are scarcely longer than on earth. Through an atmosphere somewhat less dense the stars will appear in splendor, enriched by two small moons. The smaller of these not only will seem to move with great speed but in an opposite direction from the apparent movement of the stars; indeed, it revolves about Mars faster than the latter rotates upon its axis.

"At certain epochs, either in the morning or evening, the earth will be visible as the morning or evening star, respectively brilliant in the dawn or evening dusk, the latter of short duration because of the rarity of the Martian atmosphere. The sky will appear darker during the daytime and the sun, a third smaller than from the earth, will illumine less brilliantly the doubtless more monotonous landscape. The most reliable observations indicate a ground with very little relief, probably almost everywhere level, cut here and there with enormous swamps."

JUPITER, SATURN, URANUS AND NEPTUNE

How about conditions on the giant planets, Jupiter, Saturn, Uranus and Neptune? Unfortunately, a human traveller would no longer find himself upon solid ground in the strict sense of the word. For it is probable that these worlds are still fluid, or at any rate, semi-fluid, making a landing place virtually impossible. However, supposing that the traveller could alight on Jupiter, for instance, would he be able to see the heavens through the thick and dense atmosphere whose storminess we can observe from our earth? Imagining such to be the case, he could see the sun as a tiny disk, shining with light twenty-five times fainter than that seen from the earth. That would be very meager for a sky so heavily clouded. Jupiter's globe turns upon its axis once in 9 hours and fifty-five minutes. The succession of day and night therefore is very rapid; only 5 hours elapse between the rising and the setting of the diminutive appearing sun which passes rapidly across its sky.

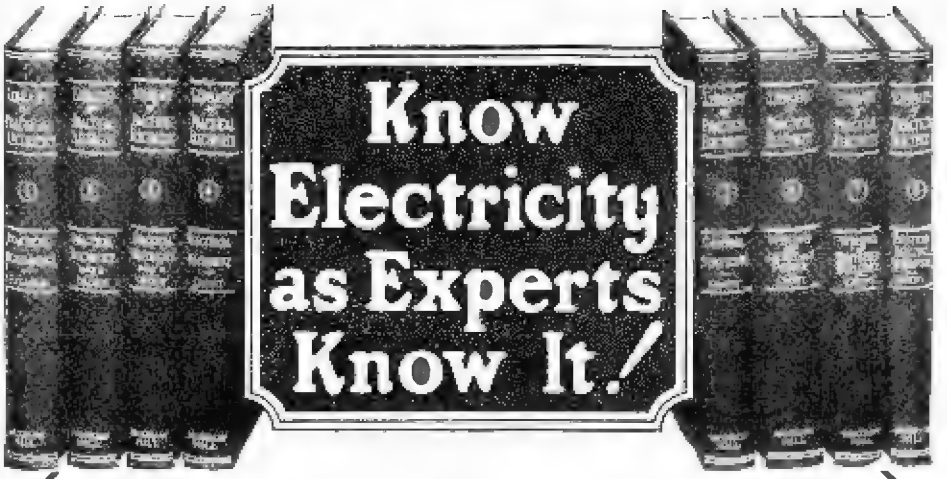
"Jupiter has 9 moons but only 5 are visually of any importance nor can all be seen at the same time. Their apparent size, reckoned from their actual size and distance from Jupiter, shows them to be comparable to our moon. They are of greatly diminished brightness since the sun illumines them much less intensely."

The moons of Jupiter offer perhaps more solid footing. From the nearest one Jupiter itself would look like an immense moon, 10,000 times larger than the moon looks to man from the earth.

SATURN

"Along with this same order of grandeur of ideas, an even more astonishing spectacle awaits the traveller who sets foot upon the satellites of Saturn, the nearest one especially. Situated in the plane of Saturn's ring, the observer would see only a bright bar crossing the enormous globe of Saturn, but excessively distorted in dimensions by perspective, the whole system presenting very different aspects than as seen from the earth. Add to this the eclipse of a portion of Saturn by the shadow of the rings, the phases of the enormous globe changing with the direction of the light from the sun, and we still have only a partial conception of the views that would meet our eyes.

"If it were possible to land on Saturn, and here the same doubt arises as in the case of Jupiter, the sky would have an appearance equally strange. From different points of the globe, this sky, dotted with numerous moons, would be traversed by the luminous rings in varied aspects.



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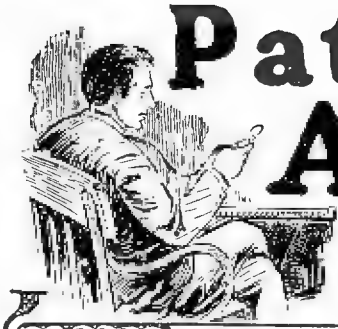

Patent Advice

Edited by
Joseph H. Kraus

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches, and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

STATIC DISPENSER

(1076) Albert Rosenstein, Savannah, Ga., asks whether he can sell an invention before patenting it and also what we think of an idea for grounding any static electricity which may develop in a truck while gasoline is being poured into a tank or which may be picked up by a motor truck on a stormy day. He claims that it is better than the chain method, but he wouldn't divulge the principles to anyone.

A. 1. There is of course no objection to selling an idea before it is patented. If you know the party with whom you are dealing and he knows you, and both of you are confident that you will not cheat each other, by all means proceed with the sale.

You give us no idea concerning the construction of your lightning arrester; consequently, we are not in a position to advise as to whether the suggestion is practical or not.

Appertaining to your third statement, that you would not divulge the secret to anyone, how do you suppose any manufacturer would be willing to undertake the purchase of your idea? The action may be likened to purchasing a cat in a bag. You might know, but the purchaser would not, as to what he was getting. You might believe the cat to be worth $100.00, and the purchaser himself hold that the cat is not even worth $5.00. If you desire that your idea be sold, there is only one way to effect its sale, and that is to give the purchaser every bit of information at your disposal. You would have to divulge the invention to the patent attorney anyway and likewise to the patent examiners. If it is not explained in its entirety, you cannot secure a patent. Every patent is so worded that those gifted in the art can understand and duplicate the invention.

ELECTRIC STENCIL, AUTO JACK, BURGLAR ALARM AND CIGAR LIGHTER

(1077) C. P. Craig, Martinsville, Va., asks our opinion on the following:

1. An electric-heated stencil made in the form of a branding iron, on one end of which a die will be found which will burn the name of the manufacturer into any wood articles made by the same.

2. An automobile lift jack with casters on its base and provided with a long handle, so that it can easily be put under a car.

3. An automatic electric burglar alarm for store windows, providing for an air space and a sensitive diaphragm located in this air space so that if the window is broken, the escaping air will cause the diaphragm to close the circuit.

4. An electric cigar lighter with a gauze in the front of it so that when the cigar is pressed against it, the heating coil will warm up and an electric bulb will flash on an advertisement.

A. 1. The electric brander suggested by you is not a new idea and many of these articles are being used today. It is doubtful if you can secure a patent on such a suggestion, even if you did use a thermostat to control the temperature of the iron.

A. 2. Every garage will show you a lift jack provided with casters which can be rolled under a car and which by operation of the handle will raise the car. Two or three, or sometimes even more of these can be found in any large garage in the cities and out of town districts.

A. 3. The automatic burglar alarm designed by you is not entirely new and it is not a very feasible suggestion because some method must be provided for maintaining a pressure of air, and the windows of the bank or store must be double and quite firmly sealed to prevent escape of that air. If there is any leakage of air, then the diaphragm will close the electrical circuit in but a short time. If the windows are absolutely tight, it becomes quite impossible to change any display which may be located within the air pocket and if double windows are provided at the outside, then condensation of moisture between the two panes of glass can be cleaned with difficulty only. Altogether, the proposition seems to us to be very unattractive.

A. 4. The automatic cigar lighter is a little more novel, but it is not a good plan because it takes quite a while for current to heat the coil, and the average individual purchasing his cigars in a cigar store is generally in a hurry to get away. They want a light immediately, without having to wait even thirty seconds for it. This feature, however, is the best of the group upon which you requested information, but even this we do not consider to be very practical. We advise no further action.

RECORDING AN IDEA

(1078) A. M. Baroody, Richmond, Va., asks how he can record a patent before proceeding to determine if the same is worthy of a patent.

A. 1. There is absolutely no way to record a patent. Years ago, caveats were issued by the U. S. Patent Office, which permitted an inventor to protect his idea while he was working upon the same and before he had proceeded to apply for a patent on it. Caveats have been discontinued because many ideas were being tied up in them and too many legal difficulties were encountered. Today the best thing to do is to establish as many priority claims as can possibly be established and then proceed with patenting, after having had a search made. Several good methods of establishing priority are here given.

1. Place detailed drawings and full descriptions on one single sheet of paper.

2. A statement that you believe yourself to be the original inventor should then be affixed to the bottom of the sheet of specifications and this should be sworn to before a notary public, who will affix his seal, stamp and date.

3. A duplicate of this same sheet, identically worded, should then be placed in an envelope and mailed to yourself. The envelope should be sealed at the back with three seals, so that it cannot possibly be opened without breaking those seals. This envelope is not to be opened except in court to settle any lawsuits.

4. The first sheet is for your files. This should be shown to as many friends as you care to trust with it and every time that anyone of them sees the plans, they should affix their names to the paper and on the dateline put the date on which the invention was explained to them. The greater the number of names, the better is your protection.

5. Reduce the invention to practice; by that we mean to build a model. After you have built the model and have seen it work, take photographs of it and have a notary affix his signature and seal on the back of each photograph.

6. Any method of tying up the date with the date of your conception establishes further priority claim.

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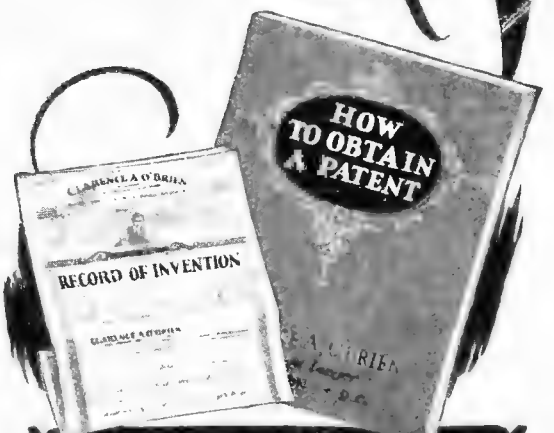

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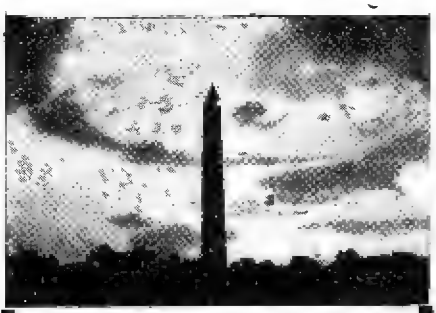

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Miniature Cities—How Built

(*Continued from page* 1030)

SOIL FOR MINIATURE SCENES

The grain of the actual soil becomes immediately too coarse. Without its native moisture and temperature it dries out and loses its natural color. Under the necessity of miniature irrigation it becomes so much mud. The exhibits placed upon it would become dirty and unsightly. And last but not least, for purposes of visible effect, soil seen over an expanse of countryside takes certain reflected hues from the spectrum which disappear when the soil is placed on a miniature terrain, foreign to the atmospheric and lighting conditions of its natural habitat.

HOW SOIL FURROWS WERE MADE

In this case the reflected colorings of the district were studied in their true relation to the soil-color. The medium selected to imitate soil was Textone, a composition which is pliable in its application but will harden like cement in twenty-four hours. The furrows in the ground were reproduced by means of a comb selected because the teeth most nearly approximated upon the scale, the distance between the furrows in the orchard. The correct shade of coloring had been mixed and incorporated into the Textone composition before grading the mixture upon the base of the exhibit.

IMITATING FIG TREES

A study was made of the formation of fig trees. Necessarily the configuration of trunk and branches must be reproduced from a natural but lasting plant, which carries an accurate resemblance to the Creator's originals. Many bushes were tried and discarded, since their twigs were too brittle and perishable and not close enough in design.

Finally a plant was found from the roots of which could be selected innumerable offshoots each one bearing a perfect resemblance to a fig tree. The roots of most plants are fibrous and enduring; decidedly tough as compared with the part which grows above the ground. As these were selected, cut and measured on the scale, they were passed on down the bench where they were dipped in shellac.

SAW-DUST FOLIAGE

For foliage a certain grade of saw-dust was selected, immersed in light green dye and dried in the sun. It was taken from the drying trays and dumped into a large receptacle, where it awaited the arrival of the tree-trunks which, after the shellac treatment, had been dipped in silver gray coloring, representing the bark, dried, and then dipped into hot glue. Glistening with the hot glue the trunks were plunged into the colored saw-dust, which immediately clung to all of the natural branches and twigs. The miniature trees were then set out to dry where subsequently they were sprayed with two successive treatments of yellow and blue-green tint matching the natural colorings of fig leaves.

All of the miniature buildings were lighted, being wired with small bulbs hooked up in series.

Miniature irrigation was introduced into the exhibit, the water bubbling up out of the white stand-pipes seen in the center of the photo. The exhibit was tilted slightly to provide gravity, the water being carried off by means of a drain not visible in the display.

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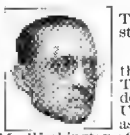

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Flying Blind

(*Continued from page* 1031)

The English airport at Croydon may be flown into by the new flight system, Tempelhof at Berlin, and Le Bourget at Paris may now receive planes in complete fogs. By throwing up illuminated balloons several hundred feet at each corner of the field, by guiding the airplane with radio beacons to the vicinity of the balloons, and then by speaking with the pilot over radio telephone, informing him of just how much clear space he has under the fog which covers the field, the plane may safely be brought in. The same schedule of conduct will bring a plane in even if the fog completely covers the field, but the Navy has recently developed a method of fog dissipation to an altitude of approximately two dozen feet, which, when it is applied to air ports, will insure at least 24 feet of clarity over the field, and the pilots can be so informed by radio telephone. Only when a plane would be maneuvering to land would the device be operated; or when planes were taking off. However, these efforts on the ground are but adjuncts to the Ocker-Myers flying system, which involves only activities in the air when pilots are *flying blind* in fog or on dark nights, when heavenly and earthly lights are not visible.

HOW THE PILOT "FLIES BLIND"

The Ocker-Myers system employs no instruments not already devised and in use on the better-equipped aircraft. It involves almost solely a mental principle, and pilots are instructed not only to use the instruments as indicators, but to use them in a concentrated manner, carefully and sternly refusing to listen to their own instincts, or to what they think their plane is doing in a fog. The pilot must educate out of himself every tendency to react in a fog to what he *feels* he is doing, and react only to the instruments. *He must not take his eyes off the bank and turn indicator, when the fog is once entered, except for extremely rapid glances to his fuel, air speed, altitude, rate of climb and compass meters. He must return his eyes to the bank and turn indicator at once, and concentrate on it*—for, curious thing, no vertigo or sickness will he feel so long as he concentrates on this artificial horizon, after all sight of earth and heavens is gone. However, this concentration is not absolutely necessary so long as he can see a star or a beacon on the earth, though he could, of course, continue to fly if he wished, without looking to earth or sky, but by simply concentrating on his instruments. He *could* do this, but it is always more satisfactory to get a reassuring glance at some outside bearing point.

"NATURAL FLYERS" NOW TABOO

It has come to instrument flying pure and simple, and already the Pacific Air Transport will turn down a pilot who declares he flies by instinct. It is only a matter of months since even Army authorities favored the so-called instinctive pilot, he who "felt" the air, and was a so-called "natural pilot." Habituation and liking for flying are still desired, but the pilots desired today, as a result of the new discoveries in the human mind, must be men capable of turning to the instruments and auto-hypnotizing themselves away from their instincts.

AIR FATALITIES DUE TO "EAR CANALS"

A simple human misconception, as readily correctible twenty years ago, as now, has led more than two thousand air navigators to their deaths. It is the gigantic misunderstanding of the human vestibular, or semicircular canals in the inner ear, as a balanc-

(*Continued on page* 1050)

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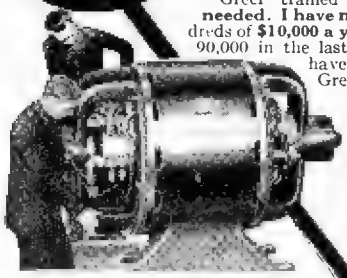

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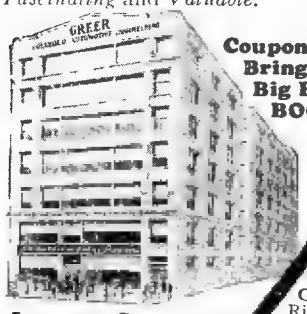

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The Metal Emperor

By A. MERRITT

(*Continued from page* 1001)

or small, and no matter how many, that doesn't by this time know all about us."

"That's true," I nodded.

"We'll probably be received with demonstrations of interest by the populace as welcome guests," said Drake. "Probably we'll find a sign—'welcome to our City'—hung up over the front gate!"

Ruth smiled, a trifle tremulously.

"We'll come back," he said. He put his hands on her shoulders. "Do you think there is anything that could keep me from coming back?" he whispered.

"Well," I broke in, "we'd better be starting. I think as Drake does, that we're tabu. Barring accident, there's no danger. And if I guess right about these creatures, accident is impossible."

"As inconceivable as the multiplication table going wrong," Drake assured her.

And so, quickly, we made ready. Our rifles would be worse than useless, so too our pistols. Canteens filled with water, a couple of emergency rations, a few instruments, including a small spectroscope, a selection from the medical kit—all these we packed in a little haversack which Drake threw over his shoulders.

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TUNE IN ON WRNY

I pocketed my compact but exceedingly powerful field-glasses. To my poignant and everlasting regret, my camera had been upon the bolting pony, and Ventnor had long been out of films for his. We were ready for our journey.

Our path led straight away, a smooth dark-grey road whose surface resembled cement packed under enormous pressure. It glistened faintly as though overlaid with some vitreous coating. It narrowed abruptly into a wedged way that stopped at the threshold of Norhala's door.

Diminishing through the distance, it stretched straight as an arrow onward, and vanished between the perpendicular cliffs which formed the frowning gateway through which we had passed the night before. Now as then, a mistiness checked the gaze.

Ruth with us, we made a brief inspection of the surroundings of Norhala's house. It was set as though in the narrowest portion of an hour-glass. The precipitous walls marched inward from the gateway, forming the lower half of the figure. At the back, they swung apart at a wider angle. This upper part of the hour-glass was filled with a parklike forest. It was closed, perhaps twenty miles away, by a barrier of cliffs.

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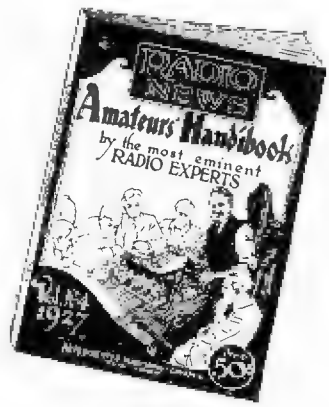

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How, I wondered, did the path which Yuruk had pointed out to me pierce them? Was it by pass or tunnel, and if it was there why was it the armored men had not found and followed it?

The waist between the two wedges was a valley not more than a mile wide. It was like a garden, dotted with flowering and fruiting trees, with gorgeous shrubs and fragrant lilies, and here and there a tiny green meadow. In its center stood the half-globe of blue that was Norhala's dwelling—an immense, bisected bubble of froth of molten sapphires and turquoises.

We had no time to study its beauties. A few last instructions to Ruth, and we set forth down the gray road. We had hardly taken a dozen steps when there came a faint cry from her.

"Dick! Dick!"

He ran back to her and caught her hands in his.

"Dick," I heard her whisper. "Dick—come back safe to me!"

His arms closed about her, hers tightened around his neck, black hair touched silken brown curls, their lips met and clung.

In a little while he joined me; head down, silent, he strode along.

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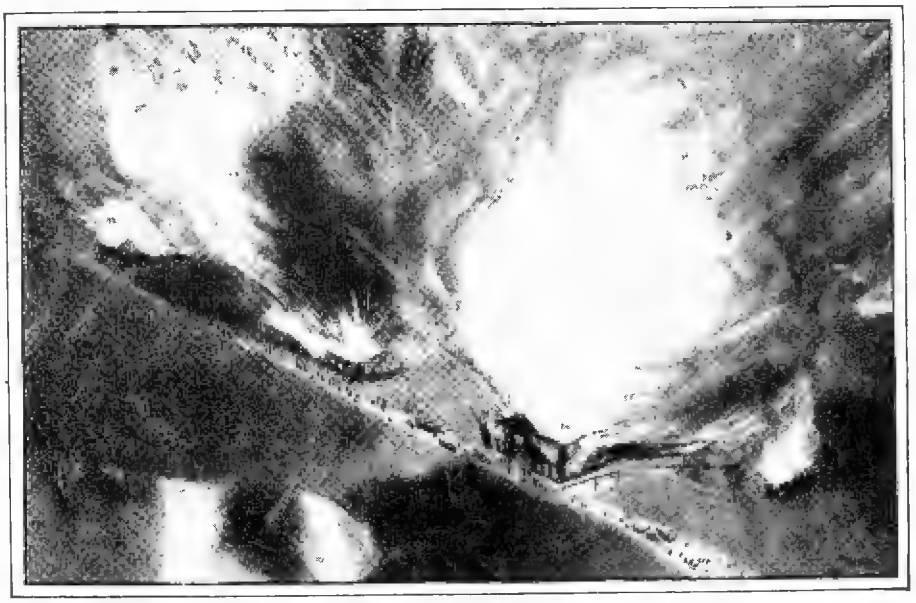
A hundred yards more and we turned. Ruth was still standing on the threshold of the house of mystery, watching after us. She waved her hands, flitted in, and was hidden from us.

"I'm glad, Drake," I said as we pushed on.

"I've loved her since first I saw her"—he gripped my hand—"and she has me, she says. Told me that if she knew I really loved her, she could make a better fight against—against what she calls the taint in her while we were away. That's why she did the proposing." He laughed. "A taint; A taint in that blessed angel! Still—she's afraid, terribly afraid, of something she thinks is in herself. I'll admit I thought the same way last night, but then I was shaky. It's nonsense—all damned nonsense!"

I had no words to reassure him, for it was not at all certain that Ruth's fear was imaginary. Her terror and shame had been too real, her description of her symptoms all too clear to be hallucinations. Was it not possible that she had been put by the sentinent Disc *en rapport* with itself and its people? That she had been subjected to some process of magnetization, not necessarily sinister, which produced in her a hypersensitivity to its will and thought?

Among our own kind we have this receptivity—minds that react to each other without the stimulus of the spoken word,



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High upon the roster of those who responded to the call of duty were the telephone workers. Operators in the danger zone stayed at their posts. Those who had left for the day and others on vacation, on their own initiative, hurried back to help handle the unprecedented volume of calls. Linemen and repairmen braved exploding shells to restore the service. Within a little over an hour emergency telephone service was established, invaluable in caring for the victims and in mobilizing forces to fight the fire which followed.

In spite of repeated warnings of danger still threatening, no telephone worker left the affected area.

Through each of the day's twenty-four hours, the spirit of service is the heritage of the thousands of men and women who have made American telephone service synonymous with dependability. In every emergency, it is this spirit that causes Bell System employees to set aside all thought of personal comfort and safety and, voluntarily, risk their lives to "Get the message through."

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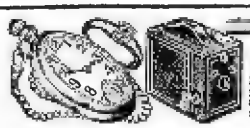

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minds which are attuned; and other minds unattuned, so that not even by the spoken or written word can our thought enter them. What mysterious currents are these along which the silent messages fly? Clearly, only something of the kind could explain Norhala's interchange of ideation with the Metal Horde. Ruth, unfamiliar with it, might well regard the sensitivity as a taint. Yet it might be of the greatest aid to us—and neither taint nor harmful to her, unless—unless—

I strove to ward off a dreadful thought!

The walls of the gateway were close. The sparse vegetation along the base of the cliffs had ceased. The roadway itself had merged into the smooth, bare floor of the canyon. From vertical edge to edge of the rocky portal stretched a curtain of shimmering mist. As we drew close we realized that this was motionless, and less like vapor of water than vapor of light. It streamed in oddly fixed lines like molecules of crystals in a still solution.

We passed within it, side by side.

Instantly I knew that whatever these veils were, they were not moisture. The air we breathed was dry and electric. I was sensible of a decided stimulation, a pleasant tingling along every nerve, a gaiety almost lightheaded. We could see each other quite plainly, the rocky floor on which we trod as well. But within this vapor of light there was no sound nor ghost of sound. Drake turned to me, his lips moved in speech—and although he bent close to my ear, I heard nothing.

We stepped out into an opening, a pocket of clear air. Our ears were filled with a high, shrill humming as unpleasantly vibrant as the shriek of a sand blast. Six feet to our right was the edge of the ledge on which we stood; beyond it was a sheer drop into space, a shaft piercing down into the void and walled with the mists.

But it was not that shaft that made us clutch each other. No! It was that up through it rose a colossal column of the cubes. It stood a hundred feet above the level of our ledge, and its length vanished in the depths. Its head was a gigantic spinning wheel, yards in thickness, tapering at its point of contact with the cliff wall into a diameter half that of the side closest the column, gleaming with flashes of green flame and grinding with tremendous speed at the face of the rock.

Over it, attached to the cliff, was a vizored hood of some pale yellow metal, and it was this shelter that, cutting off the vaporous light like an enormous umbrella, made the pocket of clarity in which we stood, the shaft up which sprang the pillar.

$5,000 for Perpetual Motion

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stocks for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stocks at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Only an instant did the great wheel spin, the screaming rock melting beneath it, dropping like lava. As though it had received some message, its motion ceased. It tilted and looked down up us. I noted that its grinding surface was studded thickly with the smaller pyramids, and that the tips of these were each capped with what seemed to be faceted gems, gleaming with the same pale radiance as the Shrine of the Cones.

The column was bending: the wheel approaching—

Drake seized me by the arm, and drew me swiftly back into the mists. We were shrouded in their silence. We crept on step by step, feeling in fancy the prodigious wheeled face stealing upon us, and afraid to look behind us lest we step too close to the unseen verge. Yard after yard we slowly covered. Suddenly the vapors thinned and we passed out of them.

A chaos of sound beat about us. The clanging of a million anvils. The clamor of a million forges. The crashing of a hundred years of thunder. The roarings of a thousand hurricanes.

The prodigious bellowings of the Pit, beating against us as they had when we had flown down the long ramp into the depths of the seas of light.

Instinct with power was that clamor. It was the very choice of Force. Stunned, blinded by it, we covered our ears and eyes.

As before, the clangor died, leaving in its wake a bewildered silence. Then the silence began to throb with a vast humming, and through that humming rang a murmur, as of a rushing river of diamonds.

We opened our eyes, stared out, and felt awe grip our throats as though a hand had clutched them.

We stood at the very rim of a wide ledge. We looked down into an immense pit, oval shaped, thirty miles in length I judged, half that as wide, and rimmed with precipices. We were at the upper end of this deep valley and on the tip of its axis. Its floor was five hundred feet below. The clouds of misty light that had obscured it the night before were gone, the air crystal clear, every detail standing out with stereoscopic sharpness.

First my eyes rested upon a broad band of fluorescent amethyst, ringing the entire rocky wall. It girdled the cliffs at a height of ten thousand feet, and from this shining zone fell the curtains of sparkling mist, the enigmatic, sound-slaying vapors. To the northwest they were pulsing like the aurora, and like the aurora they were shot through with swift iridescences, spectrums, polychromatic gleamings. Always these were ordered, geometric—like immense and flitting prismatic crystals flying swiftly to the very edges of the veils, then darting as swiftly away.

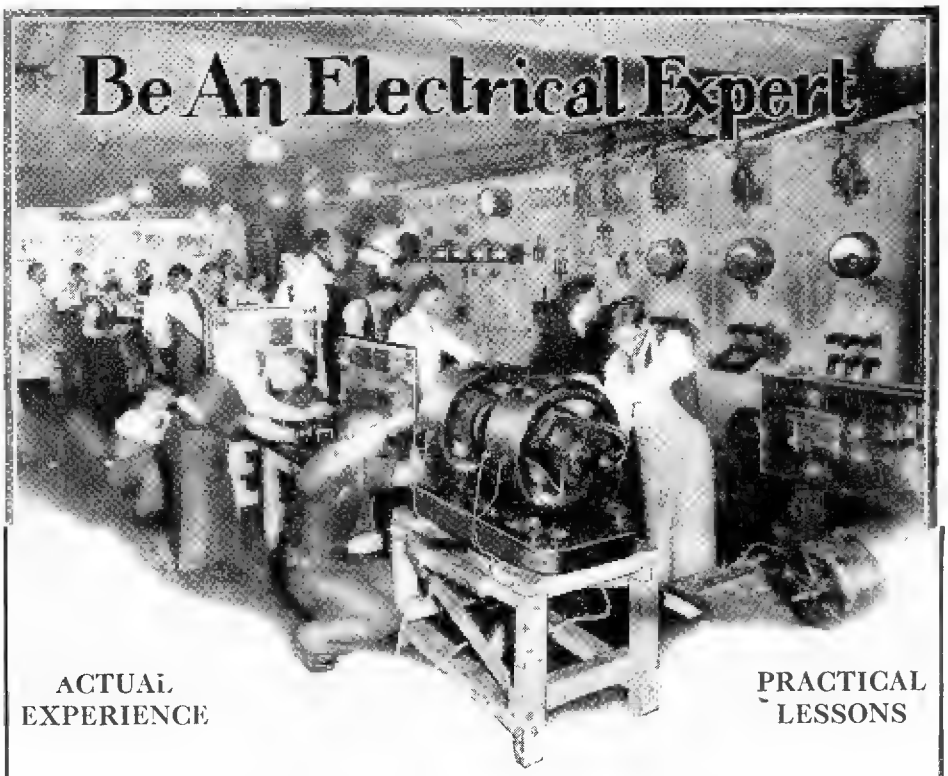
THE METAL WONDER CITY

From zone and veils the gaze leaped to the incredible City towering not two miles from us.

Blue black, shining, sharply cut as though from polished steel, it reared full five thousand feet on high. How great it was I could not tell, for the height of its precipitous walls barred the vision. The frowning façade turned toward us, was, I estimated, five miles in length. Its colossal scarp struck the eyes like a blow, its shadow, falling upon us, checked the heart. It was overpowering, gigantic—awesome as that midnight city of Dis that Dante saw rising within another pit.

It was a metal city, mountainous.

Featureless and smooth, the immense wall heaved heavenward. It should have been blind, that vast oblong face—but it was not blind, and therein lay intangible terror. From it radiated alertness, vigilance. It seemed to gaze toward us as though every foot were manned with sentinels; guardians, invisible



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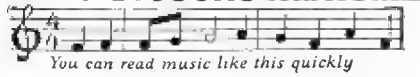
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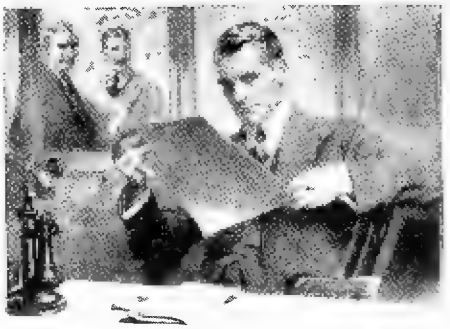

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to the eyes, whose concentration of watchfulness was caught by some hidden sense more subtle than sight.

It was a metal city, mountainous and—aware!

About its base were huge openings—its gates, I thought. Through and around these portals swirled the Metal Horde, in units and in combinations, coming and going, streaming in and out, forming patterns about the openings like the fretted spume of breakers surging into the retreating from ocean-bitten gaps in some ironbound coast.

From the immensity of the City the stunned eyes dropped back to the Pit in which it lay.

Its floor was placquelike, an immense plane as smooth as though turned by potter's wheel, broken by no mound or hillock, slope nor terrace. It was level, horizontal, and flawlessly flat. On it was no green living thing—no trees nor bush, meadow nor covert.

It was alive with movement; seethingly, terrifyingly alive. Animate with a ferment as purposeful as it was mechanical; a ferment symmetrical, geometrical, supremely ordered.

The motion of the Metal Horde.

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The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent?

To the $10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine we now add Dunninger's $10,000.00.

So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

They moved beneath us, these enigmatic beings, in a countless host. They marched and countermarched in battalions, in regiments, in armies. Far to the south I glimpsed colossal shapes like mobile, castellated and pyramidal hills. They were circling, weaving about each other with incredible rapidity—like scores of the pyramid of Cheops crowned with turrets and come to life and dancing. From the turrets issued vivid flashes, lightning bright—and on their wake rolled the echoes of far-away thunder.

A SQUADRON OF OBELISKS

Out of the north sped a squadron of obelisks from whose tops flamed and flared the spinning wheels, appearing at that distance like fiery whirling discs.

The Things lifted themselves up from their seething in a thousand incredible shapes, shapes squared and globed and spiked, and shifting swiftly into other thousands as incredible. I watched a mass of them draw up into the likeness of a tent, skyscraper high, hang so for an instant, then form into a dozen towering legs that strode away like gigantic headless and bodyless tarantulas, in steps two hundred feet long. I watched mile-long lines of them shape and re-shape into circles, into interlaced lozengers and pentagons—then lift in columns, and

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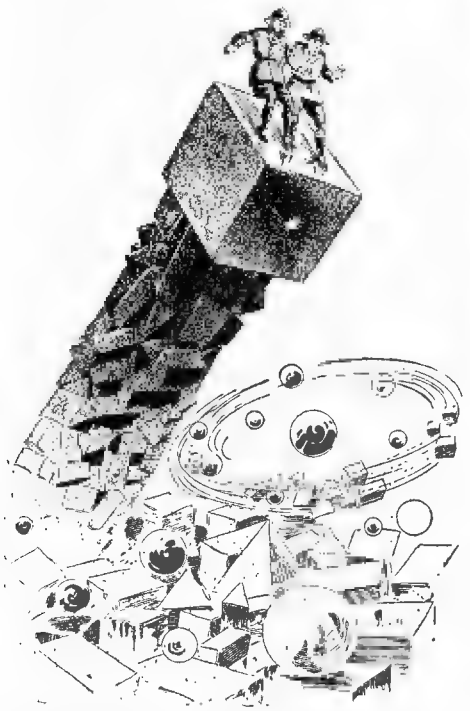
shoot through the air in an unimaginable barrage.

And when the shiftings of the hordes permitted, we saw that all the flat floor of the valley was stripped and checkered, stippled and tesselated with every color; patterned with enormous lozenges and squares, rhomboids and parallelograms, pentagons and hexagons and diamonds, lunettes, circles and spirals: harlequined yet harmonious: instinct with a grotesque suggestion of a super-Futurism. But always this patterning was ordered, always coherent, as though it were a page on which was spelled some untranslatable other-world message.

Fourth Dimensional revelations by a deity!

Commandments traced by a mathematical God!

Looping across the vale, emerging from the sparkling folds of the southernmost curtainings and vanishing into the gleaming veils of the easternmost, ran a broad ribbon of pale-green jade; not straightly but with manifold convolutions and flourishes. It was like a sentence in Arabic. It was margined



The pillar leaned over. The floor of the valley arose to meet us. Further and further over leaned the pillar. Again we were shifted to another surface of the crowning cube. Swifter, the valley floor swept up toward us . . .

with sapphire blue. Along its twisting course two broad bands of jet paralleled the cerulean shore. The ribbon was spanned by scores of flashing crystal arches. Nor were these bridges—even from that distance I knew they were no bridges. From them came the crystalline murmurings.

Jade? This stream jade? If so, then it must be in truth molten, for I caught its swift and polished rushing. It was no jade. It was in truth a river; a river shaped and prisoned into this semblance of a writing across the patterned plane.

I looked upward—up to the circling peaks. They were a stupendous coronet thrusting miles deep into the dazzling sky. In color they were an immense and variegated flower with countless multiform petals of stone; in outline they were a ring of fortresses built by fantastic unknown Gods. Up they thrust—domes and arched, spired and horned, pyramided, fanged and needled. Here were palisades of burning orange with barbicans of incandescent bronze; there *aiguilles* of azure rising from bastions of cinnabar red; turrets of royal purple, obelisks of indigo;

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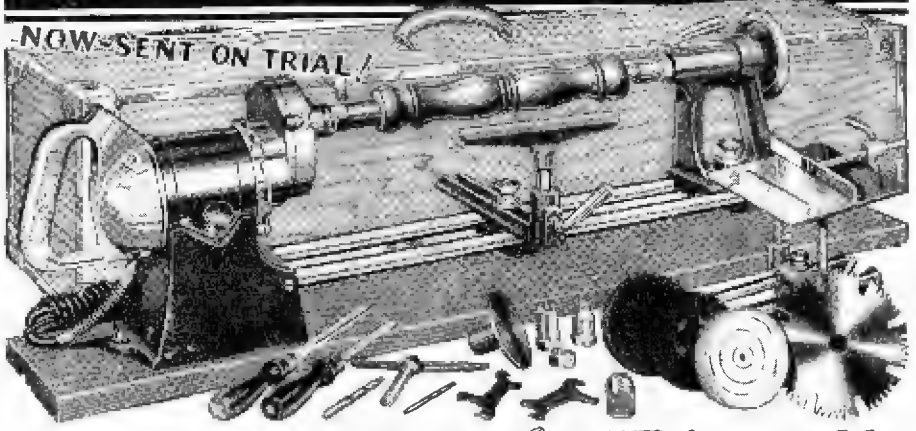

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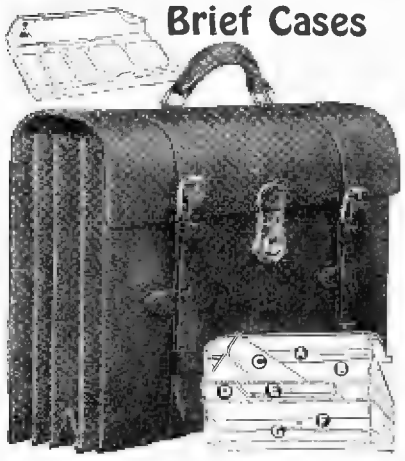

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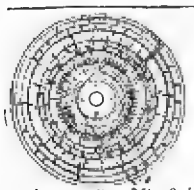

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vermillion, with citron yellows, and with rust of rubies; watchtowers of flaming scarlet.

Scattered among them were the flashing emeralds of the glaciers and the immense baroques of the snow fields.

Like a diadem, the summits ringed the oval valley. Below them ran the ring of flashing amethyst with its auroral mists. Under them stretched the vast and patterned flat, covered with still symbol and inexplicable movement. Their summits brooded upon the blue black, metallic mass of the watchful City.

Within encircling walls, over plain and over that City hovered a spirit not to be understood by man. It was like an emanation from stars and space.

Down from the ledge where we stood fell a steep ramp, similar to that by which, in the darkness, we had descended. It dropped at an angle of at least forty-five degrees; its surface was smooth and polished.

"Hell!" Drake emerged from his trance of wonder into practicality. "We can't walk that. Once we get started—there isn't a traffic cop on Long Island who could catch up to us."

Rules for Model Contest

(*Continued from page* 1006)

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based on: A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against drainage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the May contest much reach us on or before the 25th of February.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

"Maybe there's another way," I began—and was still.

Through the mists a shining block peeped at us. It paused, seemed to perk itself, and spun so that in turn each of its six faces took us in.

I was lifted upon it by multitudes of little invisible hands. Drake was whirled up beside me. The block swept away from the ledge and swayed for a moment. Under us, as though we were floating in air, the valley lay stretched. There was a rapid readjustment, a shifting of our two selves upon another surface. I looked down upon a tremendous slender pillar of the cubes, dropping five hundred feet to the valley's floor; a column of which the block that held us was the top.

Although the whirling wheel that had crowned it was gone, I knew the column for the Grinding Thing from which we had fled. The questing block had been its scout. It had sought us out through the mists, had caught us and delivered us!

The pillar leaned over. The floor of the valley arose to meet us. Further and further over leaned the pillar. Again we were shifted

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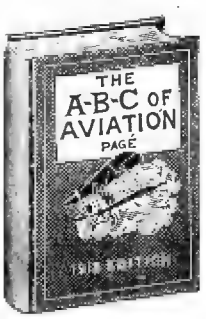

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to another surface of the crowning cube. Swifter, the valley floor swept up toward us. There was a little shock.

We stood upon the floor of the Pit.

And breaking from that which had carried us there came score upon score of the cubes. They broke from it, disintegrating it. They circled about us, curiously, interestedly, twinkling at us from their deep sparkling points of eyes.

Then suddenly I was lifted once more and tossed to the surface of the nearest block.

The cataract of the globes stopped. . . . Slowly, they advanced. We were pushed forward, lifted by that force which I can always only liken to myriads of tiny invisible hands. The shining arcs of their backs undulated beneath us.

I spun upon it while its tiny eyes searched me. It tossed me to another. I caught a glimpse of Drake's body drifting through the air.

The play became more rapid, breath-taking. It was play—I realized that. But it was perilous play for us. I felt myself as fragile as a doll of glass in the hands of careless children.

A score or more of the cubes merged, and clicked into an obelisk form that tossed me across a hundred feet of space. As I flew, I saw that there were now thousands of the Metal People crowding about the spot of which we were the nucleus. Their squared and curved and angled surface gleamed like pale blue steel. I caught a glimpse of other hundreds raising themselves from the throng in pillars and fan-shaped columns, thrusting themselves up to look at us.

A great globe came coursing along. It stopped, abruptly. In mid-flight I was checked and drawn downward, and then hung poised a foot above the surface of this sphere. The unknown force it wielded held me suspended while it spun beneath me, examining me.

I was tossed to another waiting cube, and the globe spun away. On the ground, not ten feet from me, was Drake, face white, swaying dizzily. One of the great gateways of the City was close. Suddenly the cube that held me tightened its grip, tightened it so that it drew me helplessly down upon its surface. Before I dropped, Drake's body leaped toward me as though drawn by a lasso. He fell at my side.

Then, like a mischievous boy bearing off spoils, the block that held us raced away, straight for the open portal. A blaze of incandescent blue blinded us, and again as the glare faded Drake lay beside me—a skeleton form. Swiftly flesh melted back upon him, clothed him.

The cube stopped; the unseen hands raised us, slid us gently over the edge and set us

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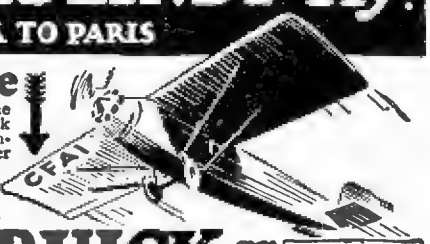

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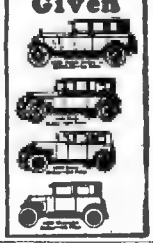

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upright on the floor. The cube sped away.

All about us stretched another of those vast halls in which burned on high the pale-gilt suns. Between its colossal columns streamed thousands of the Metal Horde, no longer hurriedly, but quietly, deliberately, sedately.

We were within the City—even as Ventnor had commanded.

CHAPTER IXX.
THE CITY THAT WAS ALIVE

CLOSE beside us was one of the cyclopean columns. We crept to it, and crouched at its base opposite the drift of the Metal People. We felt like ants in that tremendous place, the weird luminaries gleaming about it like garlands of frozen suns, the hosts of animate cubes and spheres and pyramids trooping past. These ranged in size from shapes yard-high to giants of thirty feet or more. They paid no heed to us, and after a time their numbers lessened, thinned down to widely separate groups, to stragglers; then ceased. The hall was empty.

As far as the eye could reach the columned spaces stretched.

"Follow the crowd!" said Drake. "Do you feel just full of pep and ginger, by the way?"

"I am aware of the most extraordinary vigor," I answered.

"Look here, Dr. Thornton," he suddenly said. "What do you make of this?"

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I followed his pointing finger, and then looked at him inquiringly.

"The eyes!" he said impatiently. "Don't you see them? The eyes in the column!"

I looked again. The pillar was a pale metallic blue, in color a trifle darker than the Metal Folk. All within it were the myriads of tiny crystalline points. But they were dull and lifeless. I touched the column. It was smooth, cool—with none of that subtle, warm vitality that pulsed through all the Metal People with which I had come in contact. I shook my head.

"No," I said. "There is a resemblance. But there is no force about this—stuff; no life."

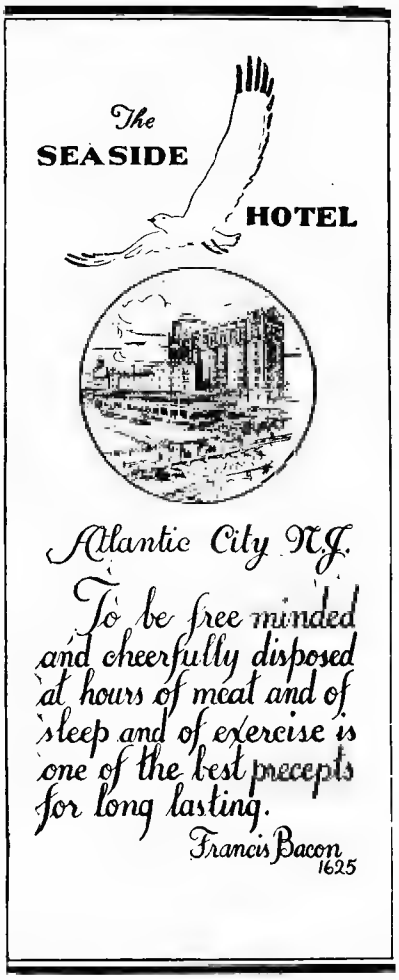
"There might be—dormant," he suggested.

"It's sheer impossibility!" I exclaimed, and wondered at my own vehemence of denial.

"Maybe," he shook his head doubtfully. "Maybe—but—well—let's be on our way."

At each pillar Drake hesitated, scanning it closely with troubled eyes. But I, having determinedly dismissed the idea, was more interested in the lights that flooded this columned hall with their buttercup radiance. They were motionless and unwinking; not discs, I could see now, but globes. Great and small they floated, their rays extending rigidly, and as still as the orbs that shed them. Yet rigid as they were, there was nothing about either ray or orbs that suggested either hardness or the metallic. They were vaporous, soft as the witch lights that cling at times to the spars of ships, weird gleaming visitors from the invisible ocean of atmospheric electricity.

When they disappeared, as they did frequently, it was instantaneously, with a disconcerting sleight-of-hand finality. When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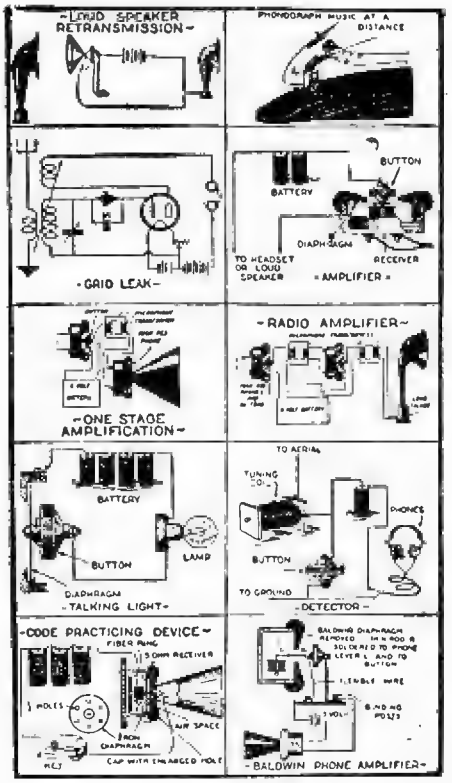

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they did vanish, immediately, close to where they had been, other orbs swam forth with the same abruptness, sometimes only one, larger it might be than that which had gone, sometimes a cluster of smaller globes, their rays crossing each other.

What could they be, I wondered—how fixed, and what the source of their light? Could they be the products of electro-magnetic currents and born of the interpenetration of such streams of force flowing above us? Such a theory might account for their disappearance, and reappearance—shiftings of the flows that changed the light producing points of contact. Wireless lights? If so, here was an idea that human science might elaborate if ever we returned to—

"Now which way?" Drake broke in upon my thoughts. The hall was ended. We stood before a blank wall which disappeared into the mists hiding the roof of the chamber.

"I thought we had been going along the way—They—went," I said in amazement.

"So did I. We must have circled. They never went through that wall unless—unless—" He hesitated.

"Unless what?" I asked sharply.

"Unless it opened and let them through," he said. "Have you forgotten those great ovals—like cat's eyes that opened in the outer walls?"

I had forgotten. I looked again at the wall. Certainly it was smooth and lineless. It was an unbroken, shining surface, a façade of polished metal. Within it, the deep set points of light were duller even than they had been in the pillars, almost, indeed, indistinguishable.

"Go on to the left," I said, none too patiently. "And get that absurd notion out of your head."

"All right," he flushed. "But you don't think I'm afraid, do you?"

"If what you're thinking were true, you'd have a right to be," I replied tartly. "And I want to tell you I'd be afraid. Damned afraid!" In my own perturbation I let slip from me an unaccustomed adverb of profanity.

For perhaps two hundred paces we skirted the base of the wall. We came to an opening, a wide and high oblong passageway. At its entrance the mellow, saffron light was cut off as though by an invisible screen. The tunnel itself was filled with a dim, grayish blue luster. For an instant I hesitated.

"I wouldn't care to be caught in there by any rush," I said.

"There's not much good in thinking of that now," said Drake, earnestly. "A few chances more or less in a place of this kind is nothing between friends, Dr. Thornton, take it from me. Come on."

We entered. Walls, floor and roof were composed of the same substance as the great pillars and the wall of the outer chamber. They were filled like them with the dimmed replicas of the twinkling eye points.

"Odd that all the places in here are square," muttered Drake. "They don't seem to have used any spherical or pyramidal ideas in their building—if it is building."

Now that he had called my attention to it, I recollected that so far in the architecture I had seen neither curve nor triangle. All was mathematically straight up and down and across. It was strange—still we had seen little as yet.

There was a warmth about this passageway we trod, a difference in the air. The warmth grew, a dry heat, stimulative rather than oppressive. I touched the walls. The warmth did not come from them. As we went on the heat increased.

The passageway turned at a right angle, continuing in a corridor half its former dimensions. Far away shone a high bar of pale yellow radiance, rising like a pillar of light from floor to roof. Toward it, perforce, we trudged. Its brilliancy grew. A few paces away from it, we stopped. The yellow luminescence streamed through a wide

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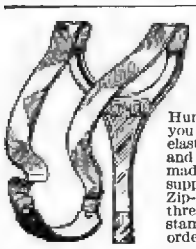

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slit in the wall. We were in a cul-de-sac—for the opening was not wide enough for either Drake or me to push through. The curious heat enveloping us came with the light through the slit.

We peered through. At first all that I could see was a space filled with saffron radiance. Then this was splashed with tiny flashes of the jewel fires, little lances and javelin thrusts of burning emeralds and rubies, darting gem-hard flames rose-scarlet and pale sapphire, quick flares of violet.

NORHALA APPEARS UNEXPECTEDLY

Through the irised, crocus mist swam the radiant body of Norhala!

She stood, clothed only in veils of hair that glowed like spun silk of molten copper, her strange eyes wide and smiling, and galaxies of tiny stars sparkling through their gray depths. And all about her swirled a countless host of the Little Things.

From them came the gem fire piercing the aureate mists. They played about her in scores of swiftly forming, swiftly changing, goblin shapes. They circled her feet in shining, elfin rings; then opening into flaming discs and stars, shot up and spun about the white miracle of her body in girdles of multicolored living fires. Mingled with discs and stars were tiny crosses, gleaming with sullen, deep crimsons and smoky orange.

A flash of blue fire, and a slender pillared shape leaped from the floor. It became a coronet, a whirling, flashing halo toward which streamed up the flaming tendrillings of Norhala's tresses.

Other halos circled her arms and breasts. They spun like bracelets about the outstretched arms.

Then like a swiftly rushing wave a host of the Little Things thrust themselves up, covered her and hid her in a jewelled cloud.

I saw an exquisite arm thrust itself from their clinging. I saw her head emerge from the incredible draperies of living jewels. I heard her laughter, sweet and golden and far away.

Madonna of a Metal People!

"Their babies!" I whispered.

"Their nursery," sighed Drake. "The nursery of the—Little Things!"

Norhala was gone, blotted out from our sight. Gone too were bar of light and the chamber into which we had been peering. We stared at a smooth, blank wall. With ensorcelled swiftness the wall had closed, even as we had stared through it; closed so quickly that we had not seen its motion.

But the opposite wall was opening!

First it was only a crack, then rapidly it widened. I gripped Drake and shrank with him into the farthest corner. There stretched another passageway,. Far down it we glimpsed movement. Closer that movement came. Out of the mistily luminous distances, three abreast and filling the corridor from side to side, raced a company of great spheres. We cowered back from their approach—back and back, arms outstretched, pressing against the barrier, flattening ourselves against the shock of the impending and destroying impact.

"It's all up," whispered Drake. "They're bound to smash us. Get back to Ruth if you can. Maybe I can stop 'em!"

He leaped straight in the path of the rushing globes, now a scant two-score yards away. He stood, head held high, a human straw against the onpouring metal avalanche.

The cataract of the globes stopped, halting a few feet from him just as I reached his side. They contemplated us, seemingly astonished. They turned upon themselves, as though consulting. Slowly, they advanced. We were pushed forward, lifted by that force which I can always only liken to myriads of tiny invisible hands. The shining arcs of their backs undulated beneath us. Their files swung round the corner, and sped down the passage by which we had

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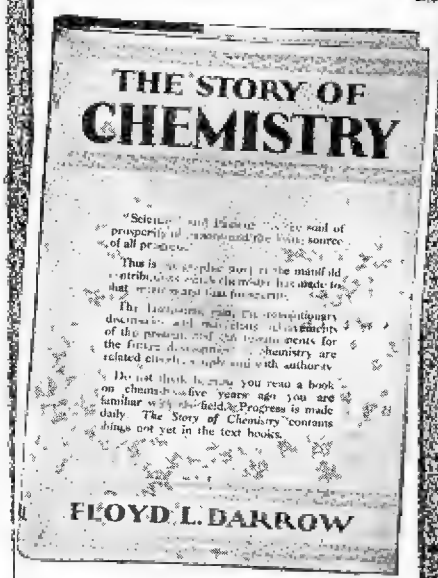

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come from the immense hall. And when the last rank had passed from under us we were dropped softly to our feet and stood swaying in their wake.

A curious frenzy of helpless indignation shook me, a rage of humiliation, obscuring all gratitude I should have felt for our escape. Drake's eyes blazed.

"The devils!" He raised clenched fists. "The insolent, domineering devils!"

We stared after them.

Was the passage growing narrower—closing? Even as I gazed I saw it shrink; saw its walls slide silently toward each other! I pushed Drake into the newly opened way and sprang after him.

Behind us now an unbroken wall covered all that space in which but a moment before we had stood.

Is it to be wondered that a panic seized us and that we ran crazily down the alley that still lay before us, casting over our shoulders quick, fearful glances to see whether that inexorable, dreadful closing was continuing, threatening to crush us between these walls like flies in a vise of steel?

They did not close, unbroken and silent, the way stretched before and behind us. At last, gasping, we stopped.

And at that moment of pause a tremor shook me, a trembling of the very springs of life, the shuddering of one who faces the inconceivable, knowing at last that the inconceivable—is!

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For walls and floor and roof had broken forth into countless twinklings. As though a film were withdrawn from them, as though they had awakened from slumber, the myriads of little points of light shone upon us from the pale-blue surfaces—lights that considered us, measured us—mocked us.

The little sparkling points of light that were the eyes of the Metal People!

This was no corridor cut through inert matter by mechanic art. Its opening had been caused by no hidden mechanisms. It was a living Thing—walled and floored and roofed by the Horde itself. And its opening, as had been the closing of that other passage, was the conscious, coordinate and voluntary action of the living walls. An action that obeyed and was directed by the communistic will which, like the spirit of the hive and the soul of the formicary, animated every unit of them.

The realization overwhelmed us. If this were true, then those pillars in the vast hall, its towering walls—all this City was one living structure! An incredible structure built of the animate bodies of countless millions! Tons upon countless tons of them, shaping a gigantic pile of which every part was sentiment, mobile—intelligent!

Now I knew why it was that the frowning façade had seemed to watch us, Argus-eyed, as we had been tossed toward it. It *had* watched us. That flood of watchfulness pulsing about us had been the actual concentration of regard of untold billions of tiny eyes of the living blocks which formed the City's cliff.

A City that saw!

A City that was alive!

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(To be continued)

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Flying Blind

(*Continued from page* 1037)

ing element in the body of man. Captain Ocker, who entered the Army through the Cavalry in 1898 and who began flying in 1912 with the original Curtiss school, later becoming one of the original four Army air instructors, has now proven, with the collaboration of Surgeon D. A. Myers, after seven years of experiment, that the vestibular canals, far from balancing the body in themselves, contribute delusions in the air which lead directly to pilots spinning and diving into the ground, while they confidently believe they are on safe courses.

Many pilots who have been observed by comrades to come suddenly out of clouds spinning and continuing their spin on into the ground below, have died through this misguidance of the semi-circular canals. Until now, it has been believed they permitted their planes to get out of control, which was not the case in most instances. Had a brother pilot been sitting beside them, they would doubtless have insisted they were flying safely and on a proper course.

WHY PACIFIC OCEAN FLYERS WERE LOST

When the writer was first called into consultation with Captain Ocker and Myers, it was by a telephone message, which stated that the officers were certain they could explain the loss of most of the trans-oceanic planes which failed to arrive at their overseas destinations during the tragic circus of death which prevailed during a few months of 1927, following the momentous flight of Colonel Lindbergh from New York to Paris.

All available statistics tended to prove that so many Wright Whirlwind engines could not conceivably have failed in flight. *The testimony of the few successful overseas flights showed that all the successful pilots suffered a number of spins and death-cheating moments; and further, that those who arrived at their destinations all utilized some variation of the Ocker-Myers system.* Pilot Ernest Smith, the first civilian pilot to fly the Pacific between San Francisco and Hawaii, personally attended the Ocker-Myers instructions and after his flight to Hawaii *declared that his success was entirely due to the prevention of vertigo by their method. He spun twice in the first 600 miles out, each time coming out successfully by the use of his instruments.*

Lieutenants Maitland and Hegenberger, who were also using the system, then issued the statement to Captain Ocker that the Army's success was due to the quelling of vertigo by psychological cooperation with the instruments.

HOW COL. LINDBERGH FLIES

Following these remarkable statements, it was ascertained that Colonel Lindbergh, before leaving San Diego, where his plane was constructed, had had a lengthy motion picture made of the working of his instruments while in the air in the factory test flights. These were made by Major H. A. Erickson, Army Photographic Officer at San Diego, and they were then run off privately for Lindbergh, while he studied every action of the instruments for several days. Then, working alone, he adopted the identical Ocker-Myers system without realizing the biological reasons therefor, but wise enough to understand that he had better depend on instrumental flight, though he was credited with rare *flight sense*. And the newspapers called that man "Lucky Lindbergh." If it be luck to discover through the channels of common-sense a principle worked out by a flying officer of 15 years' experience, associated with one of the leading flight surgeons

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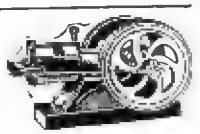

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of the world in collaboration, then indeed was Colonel Lindbergh lucky. But the appellation appears very paltry after studying the young Colonel's elaborate preparation for his feat.

SECOND TAIL SPIN OFTEN A DELUSION

Captain Ocker states that, when the "City of Dallas" plane, piloted by Captain Erwin, reported itself first in one spin and then in a second one, after which the plane was definitely lost, it had no actual second spin and that the personnel of the plane, with their instrument-board lights extinguished and flying blind, were under a common delusion regarding the second spin. The second, or "hallucination" spin could have been compensated for with the Ocker-Myers system. But they knew nothing of it. Undoubtedly, states Captain Ocker, the second spin was a delusion, and the pilot, when he worked the controls to get out of it, was simply driving himself and companion to death in the Pacific Ocean.

It might be mentioned here that Ocker knows his planes. And all their conceivable reactions. As one of the Army's first two acrobatic pilots, he, with Lieutenant (now Major) B. Q. Jones, developed all or most of the early acrobatics and special flights when the Army possessed only two planes housed in crude hangars at Rockwell Field, near San Diego, California.

The work of Captain Ocker has been the development of a device incorporating a bank- and turn- indicator and a standard magnetic compass to be added to the Jones-Barany flight-testing chair in the surgeons' offices, so that pilots can be instructed at the very beginning how their vestibular canals in the inner ear delude them in the air. This much has been done and the device has been presented to the Chief of Air Corps and the Chief of Flight Surgeons. Captain Myers has developed the biological reactions of the method, and the foremost instrument makers now in collaboration with the Air Corps are looked to for the mechanical equipment of the planes.

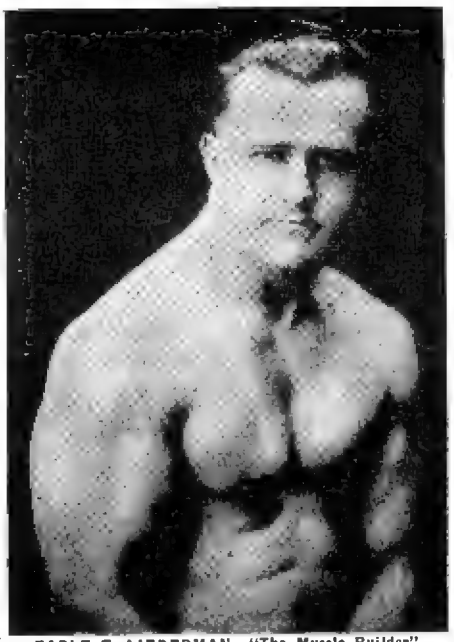
Prior to transmitting reports and duplicates of the test devices to the Chief of Flight Surgeons, Major Gerald C. Brant, commanding Crissy Field, Presidio of San Francisco, and the superior commanding officer of Captains Ocker and Myers, *issued instructions that no pilots of the Air Corps should be permitted to fly Army air craft, unless they had been instructed in the Ocker-Myers system and understood it.*

THE NEW PILOT TEST-CHAIR

By attaching the bank-and-turn indicator and a compass to the Jones-Barany chair, the results were illuminating. Men who vomited and who suffered various phenomena of vertigo, without the instruments, found themselves at all times perfectly orientated and without nausea, when the instruments were added for their undivided attention. This was achieved by mounting a case containing the instruments on the chair and causing the pilot to look upon them in such a manner that he could see nothing but the instruments and no extraneous objects in the room, thus simulating flight in clouds or fog, or at night when earthly and heavenly objects were beclouded and invisible. The photos and drawings show this new pilot test-chair.

Captain Ocker does not limit himself to the apparatus disclosed in the accompanying drawings and description, as the method and apparatus may be varied and improved, as the need arises, without departing from the spirit of his developments.

The whole invention relates to a principle discovered by Captain Ocker in 1919, and definitely perfected by November, 1926, wherein are combined the Jones-Barany turning chair, the orientator, the aeroplane, or anything that turns with such instruments as the bank-and-turn indicator, compass,



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Many say that any form of exercise is good, but this is not true. I have seen men working in the factories and mills who literally killed themselves with exercise. They ruined their hearts or other vital organs, ruptured themselves or killed off what little vitality they possessed.

I was a frail weakling myself in search of health and strength. I spent years in study and research, analyzing my own defects to find what I needed. After many tests and experiments, I discovered a secret of progressive exercising. I increased my own arms over six and a half inches, my neck three inches and other parts of my body in proportion. I decided to become a public benefactor and impart this knowledge to others. Physicians and the highest authorities on physical culture have tested my system and pronounced it to be the surest means of acquiring perfect manhood. Do you crave a strong, well-proportioned body and the abundance of health that goes with it? Are you true to yourself? If so, spend a pleasant half-hour in learning how to attain it. The knowledge is yours for the asking.

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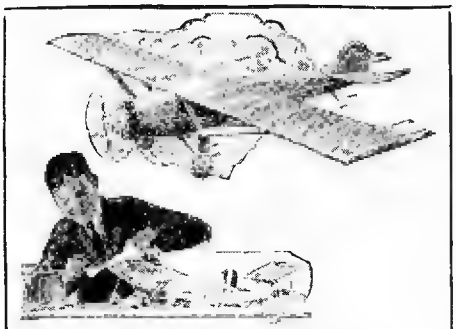

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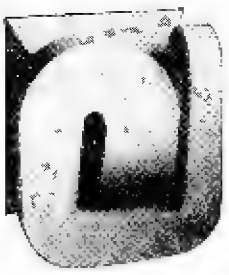

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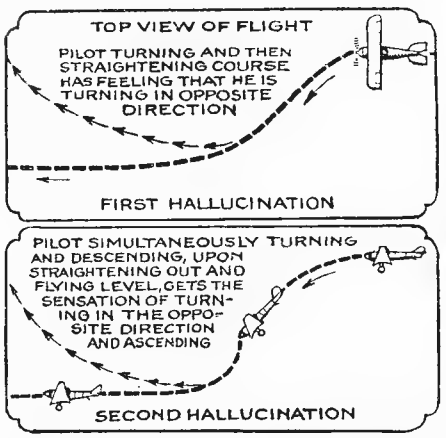
altimeter, inclinometer and air-speed indicator in a manner such as indicated, for the purpose of training and safeguarding pilots while flying in darkness, fog, storm, or any combination of these weather conditions.

The principle involved teaches the pilot that after one or more blind turns, he is suffering from a state of vertigo, which is a reaction experienced by every normal person. The instruments mentioned are to be used to correct this error of our senses, and absolute reliance can be placed in them until such state of vertigo has passed away.

The discovery also covers the use of the foot rudder in the training apparatus, to disclose the amount of deviation from the true course by the pilot when in a state of vertigo.

TWO HALLUCINATIONS PILOTS HAVE

In fog or blind flying, when the "feel" of the airplane leaves the pilot, there are two distinct hallucinations that all normal pilots are subject to: *First, when a pilot is turning and then discontinues the turn and flies a straight course, his senses tell him that he is turning in the opposite direction; and, second, when he is turning and simultaneously descending, upon straightening out and flying level, he will have the sensation of turning in the opposite direction and ascending.*


TOP VIEW OF FLIGHT
PILOT TURNING AND THEN STRAIGHTENING COURSE HAS FEELING THAT HE IS TURNING IN OPPOSITE DIRECTION
FIRST HALLUCINATION
PILOT SIMULTANEOUSLY TURNING AND DESCENDING, UPON STRAIGHTENING OUT AND FLYING LEVEL, GETS THE SENSATION OF TURNING IN THE OPPOSITE DIRECTION AND ASCENDING
SECOND HALLUCINATION

Illustrating the two major hallucinations that affect the pilot of a plane under many conditions.

These reactions are *not* shown or explained to the student or old pilot by the usual Jones-Barany chair tests or any other tests now in existence. Therefore, Captain Ocker's invention is of the utmost importance, as it thoroughly demonstrates and explains these reactions to the pilot, thus teaching him to place his faith in instruments and not in his senses. These principles have not only been tested in the chair, but also in the air by airplane, and have been found to be the same in both places.

The magnetic compass is used to demonstrate that this classic instrument causes confusion, by frequently giving an illusion *that the machine is turning around the compass, whereas the compass dial itself is turning,* due to forces caused by the rapid turning. The bank-and-turn indicator, therefore, is used as a stabilizer for the magnetic compass.

One of the objects of the device is to provide means whereby a subject under examination for his physical qualifications for flying duty, may be brought to a full realization of the inaccuracy of his physical and mental senses under conditions that may occur during flight.

Another object is to provide means whereby said subject may be caused to experience, on the ground, sensations similar to those which he would experience during flight in an airplane, when said airplane became uncontrollable due to a loss of speed, or loss of ground or horizon visibility.

It is intended to demonstrate to each pilot now in service, both Government and commercial, as well as to all pilot-aspirants the deceit which is practiced upon man by the in-

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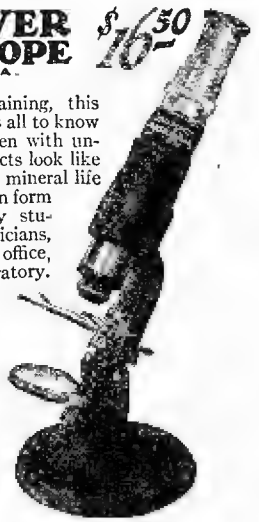

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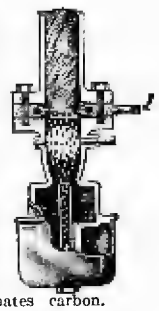

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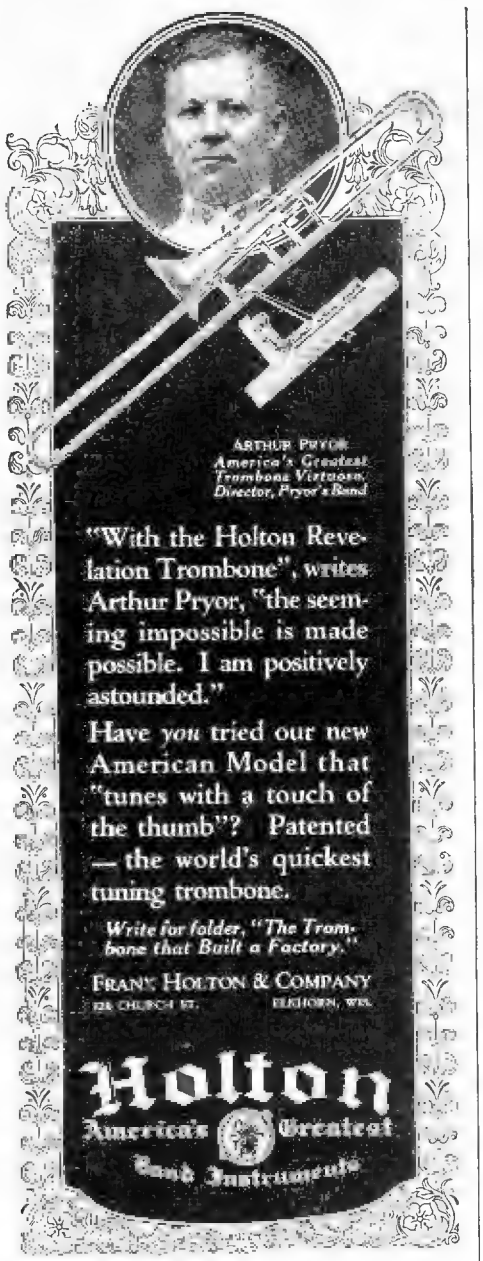
ner ear, when it is depended upon for flying equilibrium in blind flight. A very practical demonstration was given recently when a pilot attempted desperately to make a landing on what appeared to him to be a fairly good field. He had just come out of the fog and the ground was only faint below him. Try as he would, he could not land, but he felt a great pull behind him, as though some giant magnet were pulling his plane backwards to prevent his landing. He dived at his "landing" with great speed and tried to set the plane down, but every time as he slowed his motor, the plane began to slide backwards, and he had to put on full throttle in order to pull out. Furthermore, the ship labored heavily as he pulled up to avoid a crash.

Before any disaster overtook him, he fortunately discovered that he was in reality flying up and parallel to the sides of a precipice, with his nose pointed at the zenith and his tail toward the ground. Had he cut his motor to make his "landing" he would have crashed backwards and died in the valley below. Instrumental flying, rather than instinct-flying would have prevented this experience, which actually happened to one of the mail pilots of the earlier air-mail days. Today, the mail pilots are flying by instruments.

Under the Ocker-Myers instructional system, Air Mail Pilot J. L. Rutledge, of the Pacific Air Transport Company, was the first man to land a plane entirely by instrument in a fog which extended from the ground to the 5,000 feet mark on the altimeter. The act is still a dangerous one, but with fog-flying safe aloft, landings in fog are now commanding the attention of Captains Myers and Ocker. They promise some developments in this field in the near future.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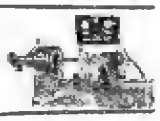

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How to Make a Barometer

By RAYMOND B. WAILES

(*Continued from page* 1009)

A sheet of paper is folded like this to make a funnel to filter and purify the mercury.

into the side of the cork so that air may enter the bottle. Two wooden clamps or cleats must be added to help support the mercury tube in a vertical position.

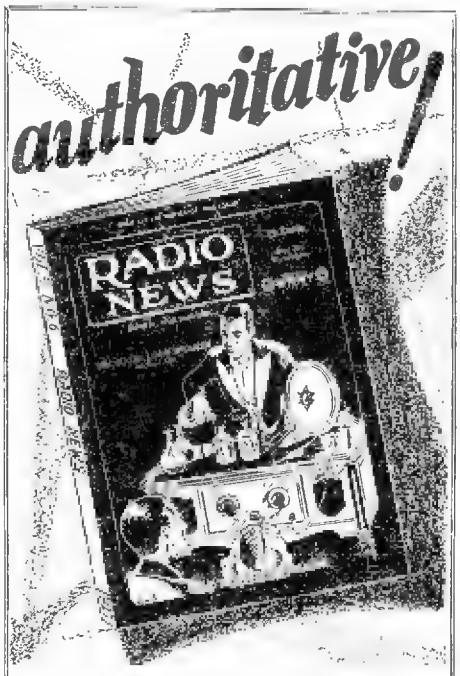
A scale is next to be added to the barometer. On the title or index page of this magazine you will find just the thing that is needed: an inch-centimeter scale. With a pen, or typewriter, paste jar and paper, revise the centimeter or metric scale so that it apparently reads 73, 74, 75, 76, 77, 78, 79 cm. On the inch scale, mark the numerals 29, 30, 31. Paste both scales on a cardboard backing, which can be affixed to the glass tube of the barometer with wire, so that the 30 and the 76 marks are exactly opposite each other. The mercury thread in the tube will move up or down according to weather conditions, and it is by making certain observations or readings of the mercury column on the inch or centimeter scales that one ascertains what the barometric pressure is.

One method by which the scale can be placed in the right position behind the glass barometer tube is by using another barometer such as an aneroid barometer, and then fastening with cotton covered wire the paper scale permanently on the glass tube, so that both barometers read the same. Another method by which the instrument can be calibrated, or the scale placed in the right position is to wait for a clear, fair day when weather reports indicate the barometer as normal. Wire or affix permanently the scale behind the glass tube so that the top of the mercury column reads thirty inches or 76 centimeters, whichever scale you prefer to use, English or metric.

As stated before, the mercury column will rise or fall depending on certain conditions. Refer to any weather book or almanac.

Good weather forecasting can be done with the aid of the encyclopedia, almanac, etc., for many suggestions and rhymy weather prophecies can be found therein.

The well of the barometer. Note the slotted cork.



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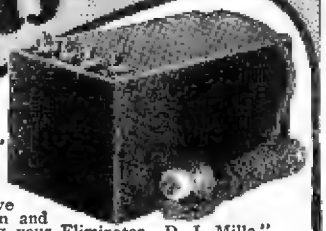

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The Case of the S-4

By H. WINFIELD SECOR

(*Continued from page* 980)

As the naval officer interviewed by the writer stated, the only successful method of raising a submarine thus far established, is by the use of pontoons, as was the case of the S-51.

Briefly explained, the method of raising a heavy and fairly delicate structure, such as a submarine, by the pontoon method, is to pass several slings around under the hull, and to these are attached on either side, pontoons sunk in place by filling them with water. To each pontoon there are attached one or more air lines connected to powerful air compressors on salvage craft above. When all the pontoons have been put it place, the compressors are all started working, and the water slowly forced from the pontoon chambers, which naturally become more and more buoyant. With the proper number of pontoons, the submarine is finally lifted.

Many caustic comments appeared in the daily press because large lifting cranes were sent to Provincetown, and then left idle without even attempting to bring up the S-4 from its watery grave. The reason these cranes were not used, is because the submarine was far too heavy, especially in her water-logged condition, for the cranes to ever be successful in lifting her. That was the statement made at the interview the writer had with the expert aforementioned, and he took occasion to nullify the suggestion of many civilian inventors by stating that it was quite impossible to have attempted dragging the S-4 into shoal water. This was so because of the great distance, and most important of all, because of the great weight of the S-4. Besides, the pulling strains might have ruptured the submarine.

Many people made the suggestion that magnets should have been secured to cables and lowered into contact with the steel hull, and the submarine thus raised completely and safely. It was absolutely impossible to do anything like this for the simple reason that the magnets would have pulled the plates off the framework of the hull, and the only way in which magnets could have been used at all, would have been if the submarine had huge iron blocks mounted at equally divided sections along the top of the hull. This of course is quite impractical.

VACUUM CUPS

OTHER inventors suggested the use of rubber (or rubber rimmed steel cups) vacuum cups placed on the lower ends of cables sent down to the scene of the wreck. When the divers had placed these vacuum cups in contact with the hull, the air was to be exhausted from them through hose lines running to the surface craft above, and in this way the wreck finally raised. The same technical objection again becomes effective; the vacuum cups would hold to the steel plates that they were in contact with, and rip the plates from the whole frame.

MARKER BUOYS FOR SUBS

AS one of our enterprising congressmen pointed out in the daily press, an order had been put through some years ago calling for the installation of a marker buoy on each submarine, this buoy to be available in cases of emergency, so that it could be released and floated to the surface, attached by a cable of course to the vessel below. This congressman raised the question as to when the order for installing these marker buoys was rescinded, and aside from this phase of the argument in regard to the S-4, a few very interesting and vital questions arise in regard to the use of buoys.

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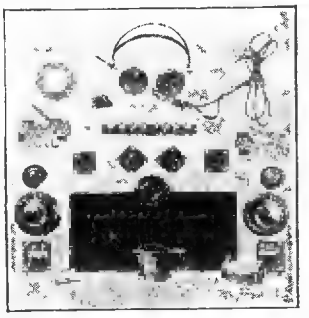

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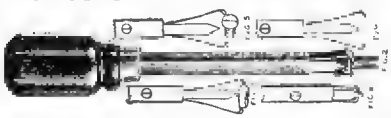

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In the first place, hundreds of inventors have sent in illustrated suggestions and plans for *crew salvage buoys*. In the more elaborate plans of this type, the inventors specify that each of the five or more water-tight compartments in a modern submarine, should have one of these crew-saving buoys; some inventors suggesting a steel buoy capable of holding one man, and others again specifying a buoy to hold three men. The first serious objection to these crew rescue buoys, is that they would take up a lot of room on the submarine, where the space is already at a premium. This one objection alone practically settles that suggestion.

The next form of buoy we come across, is the *marker buoy*. The first application of the marker buoy is for use when a submarine has sunk, out of control, so that the buoy can be released by suitable wheel gear, and allowed to float to the surface. Here it would serve as a marker to passing vessels and indicate that a submarine was lying in distress at that point. Some inventors suggest that this marker buoy could send out flashes of light in Morse code signals as well as fire rockets, and could also send out sound signals in short and long blasts corresponding to Morse code signals.

The naval expert with whom the writer talked over this idea, was in accord with the plan for marker buoys.

In regard to these buoys, there is one thing that the civilian inventor always forgets, as has been pointed out by the naval men. In the first place, unless a fairly strong steel cable joins the buoy to the sunken submarine, the cable will be ruptured as the buoy bobs about on the surface, especially if a storm occurs. In the second place, if a fairly strong cable is used, then the weight of the cable comes into the question, and a larger buoy must be used in order to be able to rise with the added weight of this heavier cable. Now again if a larger buoy is used, then quite a bit of valuable space must be sacrificed in the submarine hull to accommodate it. There are other objections of course to marker buoys, in that they may fail to rise at the desired time, or the release gear may become corroded and jammed so that they do not operate when sorely needed. One of the Navy Department experts at Washington stated that such marker buoys were officially frowned upon, for the reason that in time of war the buoy might become released in some way and float to the surface, when a submarine was hiding on the bottom of the sea. This would disclose that a sub-sea craft was lying at that spot; as soon as the buoy was spotted by the enemy, a quantity of depth bombs would be dropped on the scene, and the submarine wiped out.

The author does not agree with this official opinion, and believes that a marker buoy should certainly be installed on every submarine, and that a satisfactory and positive release gear can certainly be designed, so that there will be no danger of the buoy being unconsciously released in time of war. Also it should be possible to design it so that it will hardly ever fail to rise to the surface.

A well-known New York City inventor, who has studied the problem, suggests that every submarine should carry a buoy marker especially designed for use when rising to the surface. There is no doubt about it that at the present time it is a very weak point in submarine operation, that there is no definite and easily recognized signal by which ships in the vicinity may know that a subsea craft is about to appear at the surface. This engineer's design calls for light and sound signals in the Morse code, giving a pre-arranged signal, by which sea-faring men in the vicinity would know that a submarine was to come to the surface in say, two or three minutes at about that spot. It was the opinion of one of the naval

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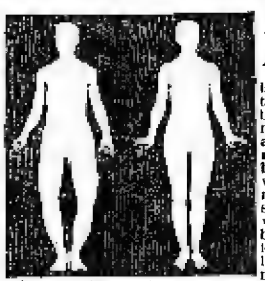

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officers to whom this scheme was explained, that when the submarine was moving through the water horizontally and gradually approaching the surface, that the buoy would be dragged at a downward angle and would never reach the surface. We do not think that this is the case, however, if the buoy is properly designed as to size, and fitted with the proper size of cable.

Another suggestion for rising signals for use on submarines takes the form of calcium carbide bombs, which can be released from a special gun on the sub-sea craft when she is about to arise, this chemical bomb exploding and giving a smoke and flame signal on the surface. It has been stated by several experts that submarines are supposed to give a rising signal of three short blasts on the under water, sound wave oscillator; but if a vessel such as the coast guard destroyer *Paulding* is not fitted with under-water listening devices, it is doubtful if these signals will save a submarine, and the S-4 accident seems to prove the point.

One expert pointed out that if the S-4 did give a rising signal on her under-water oscillator, this signal could have been heard on the *Paulding*, even *without* under-water "ears;" but the navy officer the writer interviewed did not think this possible. He further stated that although the *Paulding*, now in use by the Coast Guard service was an old naval vessel, when these naval boats are turned over to any other service than that of the navy, the sound-sensitive devices, such as under-water sound wave listening and sending instruments are removed.

ESCAPING THROUGH TORPEDO TUBES

ONE of the orthodox rescue methods supposed to be available on submarines, was the escape of the crew when trapped through the torpedo tubes. This is feasible in many instances, when compressed air is available for shooting a man out of the tube, but in the case of the S-4, due to the severe damage caused through the ramming by the destroyer *Paulding*, the men trapped in the torpedo room in the forward end of the craft, did not have the use of compressed air lines and air storage tanks in the compartment to the rear of their position.

Also it must be remembered that the S-4 landed on a very muddy bottom, and that the outer openings of the torpedo tubes were covered with mud. One of the suggestions made was that the men might have escaped through the torpedo tubes one at a time, a man opening the inside door, crawling into the tube, and then when one of the crew opened the outside door the man in the tube could crawl out and start swimming to the surface. As long as a salvage craft was over the spot, he might be in luck, for he certainly would have a bad attack of the "bends," due to the rapid change of pressure as he came up from a depth of one hundred feet. Providing the salvage boat, such as the *Falcon*, was on hand with a recompression chamber, in which the man could be placed, so as to adapt his lungs to the normal atmospheric pressure, he probably would be saved. The last two men would doubtless have to draw lots for this method of escape; and moreover it is the opinion of several engineers and naval men, whom the writer interviewed, that it was practically impossible for a man to escape in this way from the torpedo tube, as he would doubtless be drowned from the inrush of water (and mud in this case) as the outer door was opened. He could not hold his breath very long, so the water could not be admitted slowly; further, he would doubtless be drowned by thus admitting the water in slow fashion.

One of the Navy's schemes for supplying food and oxygen bottles to the crew in such a predicament as the men trapped in the torpedo room of the S-4, was explained to the writer. This scheme, which was to have been tried at Provincetown, if the

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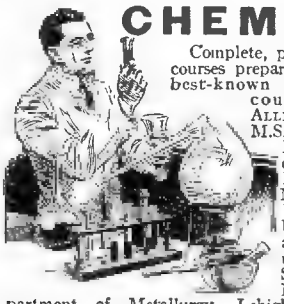

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signals from the crew had persisted a little longer, was to force open the outer door of the torpedo tube, and place some properly protected food and oxygen bottles in the torpedo tube, close the door (divers doing this work of course), and then signal the crew to open the inside door. When they opened the inside door, there would be quite a little water released into the compartment, but this would pass into the bilge space below the floor of the compartment, and then one of the men could crawl into the tube and safely obtain the oxygen bottles and food. A variation of this scheme, as the naval officer explained, was to drill a hole in the outer door of the torpedo tube and connect an air supply hose to this opening.

SEVERAL suggestions for drilling a hole through the steel wall of the submarine in order to safely connect an air line to the torpedo room, for example, were suggested. On the second day after the S-4 went down, a small steel bell with drilling attachment inside it, was sent to Provincetown by a well-known civilian concern. Coincidentally a similar idea was developed by the author, and it is shown in the illustration presented at the start of this article. By means of this drilling bell, which can be held against the hull either by water pressure, or else by electro-magnets, or as one of the navy experts suggested, by fusing it fast with an under water oxyacetylene torch, a hole could be safely drilled through the hull wall of the compartment containing the living members of the crew. As will be seen from the illustration, it is a simple matter to supply fresh air through the bell from the salvage craft above; also liquid food could be easily supplied through a hole in the center of the drill, or by some other simple means, and oxygen could be transmitted either down the air tube, or from separate tanks attached directly to the bell by divers.

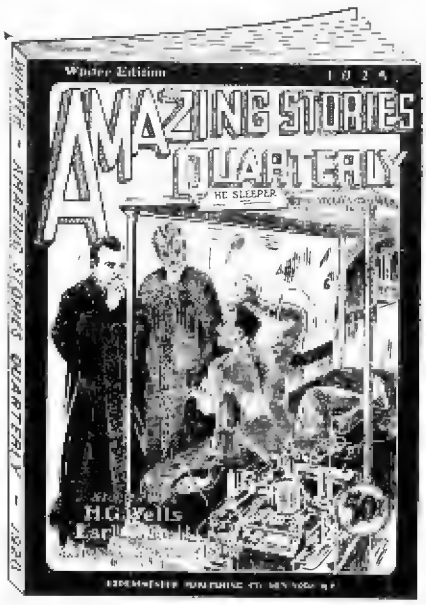
Another idea would be to have a small steel cylinder to screw into an emergency outlet fitted in the hull, and to one side of this cylinder, containing concentrated food and oxygen bottles, an air hose could be readily connected. To pass the food and oxygen supplies to the crew into the opening, the diver simply turns a handle on the end of the cylinder, as the illustration shows.

IF a sufficient quantity of air could have passed into the entombed men, Simon Lake's idea of rescuing the crew then became a very good one. When the air pressure became great enough inside the submarine, to counteract the pressure of the water, then Mr. Lake, famous builder of submarines, stated that the divers could burn a hole through the steel hull of the sub, pass in diving suits to the crew and let them come out through the hull one by one. As they came out onto the sea bottom, a line would be fastened to them and they could be hauled slowly to the surface in the same way that the divers ascend, in order to become accustomed to the reduced pressure as they approach the surface of the sea.

Simple chemical purifiers for removing carbon dioxide from the air should be placed in each compartment also; and some improved method of sending signals by sound waves from the submarine through the water, in the place of hammer signals should be provided. If the men in the torpedo room of the S-4 had had diving helmets available, they could have opened the inner door on one of the torpedo tubes, and also the outer door, donning the helmets beforehand, of course, and then worked their way out from the flooded compartment, through the tube and up to the surface, with the help of the guide lines and the salvage divers.

Either a gas flame, a mechanical cutter or other special tool should be provided in each compartment, for the purpose of cutting a hole through the wall of the submarine large enough to pass a man; in the event that these self-contained diving helmets are carried in each compartment.

The Possibility of the Great Impossible—



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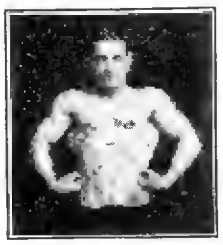

AFTER

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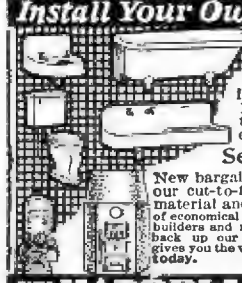

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(*Continued from page* 981)

achievements. Professor Mueh has treated some 80,000 men and women during the last few years for weak mental faculties, and Konzentrators is the result of his enormous experience. It can, therefore, be accepted as at least worthy of a trial, and those who have ventured to acquire this wondrous psychic accessory are all full of praise for the unexpected benefits they obtained.

HOW TO USE THE KONZENTRATOR

First dampen both temples with a little water; then breath several times (3 or 4) upon the center capsule (perforated) containing the concentration chemicals which the warm moisture in your breath changes into a battery.

The two antennae should just cover the temples and the whole apparatus should be placed lightly around the head without any pressure whatsoever. When the body heat (in a minute or two) has warmed up the Konzentrator you retire to a quiet place, and comfortably seated, relaxing from head to foot, thinking practically of nothing, you allow your soul to float away towards the INFINITE, letting it vibrate into the Harmonious Cosmos, whence it will return to its mortal shell equipped with new thought-power, ready to recreate every body cell, especially the neurones, our brain nerve cells which we use up by our wasteful thought action. You wear the apparatus for about ten minutes. You will then feel inspired and roused to activity. Do not resist it. Get busy with whatever work you have to do. Notice how eager you are to take up that task; to write that letter; that brief; that sermon; that poem; that music; that book; that scientific treatise, or whatever your professional work may require for you. Magically new and original ideas come to your brain at the right moment and you are wonderfully dynamic.

(Please take care of your digestive organs. Be regular in everything; avoid systematic toximea, by which your brain is naturally affected. Consult your physician in this respect.)

If you desire quick thought-results do not register a negative or skeptical attitude, saying to yourself: Now, then, let's see what this thing is good for and what it will do for me, etc., etc. . . . but rather, use Konzentrator piously, meekly with humble expectancy. Allow the psychic power of the instrument to act independently, electonically. **(No such word.—EDITOR.)** If you do this twice daily you will soon be transformed into a mental giant. Use the Konzentrator for the first time immediately before retiring (sleep will be refreshing and recreative), then in the morning immediately upon awakening preparing yourself for the day's work. As soon as knotty problems tax your mental power put on the Konzentrator and seek inspiration from it and you will not be disappointed. Thoughts come to you in logical order. Empty-headedness is a thing of the past.

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High School and College Students who cannot stick to their work are strongly recommended to use the KONZENTRATOR; in short, every man and every woman, whatever their calling, should possess this wonderful psycho-technical instrument and use it diligently.

Do not loan or allow your KONZENTRATOR to be worn by any other person. The apparatus will adjust itself to your peculiar body heat and to your own personal psychic nature and nerve centers.

Further information will follow.

In a separate postal card, sent to a "sucker" list, the following interesting statements are made by the Novom Chemical Company:

(*Continued on next page*)

In March "Radio News"

Encirling the World on a Two-Tube Set—By Charles Magee Adams

Bridge by Radio—By G. C. B. Rowe

The Screen Grid Laboratory Model Superheterodyne—By Ernest R. Pfaff.

A Four-Tube Screen Grid Receiver—By Hugh H. Knowles

The Distant Signal A.F. Amplifier—By Gerard J. Kelly

Controlling Volume in Your Receiver—By John B. Brennan, Jr.

The United States—A Broadcast Studio—By Joseph Riley

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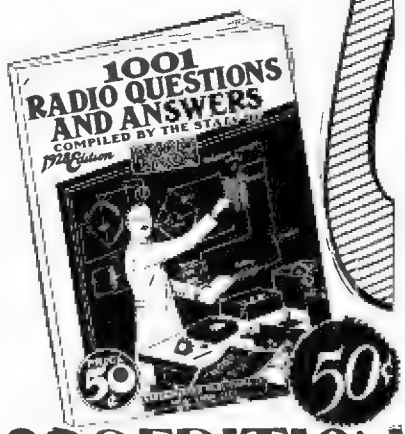

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THOUGHT KONZENTRATOR—LATEST SWINDLE

(*Continued from page* 1060)

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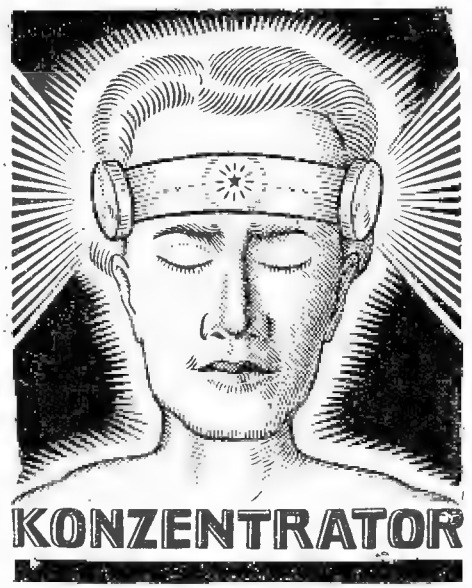
BUT this literature is really quite harmless when you compare it to what the Germans are putting out. They are actually publishing books and booklets about this new wonder, the Konzentrator, and it would take about half of the text pages of SCIENCE AND INVENTION to quote all of the wonderful cabalistic properties of the Konzentrator. The Konzentrator, by the way, is manufactured by a German concern in Wurtembuerg, the full name being Baum-Verlag, City of Pfullingen. It is interesting to note that this firm publishes a number of mystic books of a non-scientific character.

WHEN we first received the Konzentrator, we of course submitted it to all of the tests given. We dampened both of our temples with a little water, breathed several times upon the center capsule containing the famous *concentration chemicals*, but, strange to say, our breath did not change the capsule into a battery. None of the tests we made proved that anything went on whatsoever. When our body heat (as per instructions) had warmed up the Konzentrator, we retired to a quiet place, seated ourselves comfortably, relaxed from head to foot, and thought practically of nothing. But our soul had not been induced to float away towards the infinite, *and it absolutely refused to vibrate into the Harmonious Cosmos*, as per directions. We wore the apparatus for ten minutes, and had a number of people who knew nothing about it wear it also; but after the test, they all wanted to know what the joke was, because nothing was changed in their bodies, nor in the souls of the wearer. It did, however, have some effect. Some of the subjects got quite angry for taking up their time with this hokus-pokus, and we are not certain that the Konzentrator thus affected their souls and their "Harmonious Cosmos."

WE then submitted the Konzentrator to a number of laboratory tests; electric, magnetic, chemical, as well as radio test, much to the amusement of the laboratory assistants. There was, however, no indication that the Konzentrator had the slightest effect on anything. Thinking, perhaps, that our flagrant disbelief had some mystic effect upon the misunderstood Konzentrator, we next tried it on an airedale for ten minutes. The airedale was resting, and was dozing comfortably while the test went on. If he had a Harmonious Cosmos, the test did not reveal it, because the dog never moved; and when the test was over, he merely blinked his eyes at us, the same as he always does when he wakes up. Of course, the test may not have been fair to the Konzentrator, because a dog is not supposed to have a soul, and consequently the airedale could perhaps not have allowed his soul to float away toward the infinite!

BE that as it may, the test of the Konzentrator, on which we concentrated for almost a week, proved a grand flop. We would have tried other stunts with the Konzentrator, because the Novom Chemical Company told us that further information would follow, but such did not prove the case, so we reluctantly had to abandon our investigation.

Seriously speaking, the cleverness of this latest swindle is, that here we have a conglomeration of meaningless articles, which are supposed to stimulate thinking, and improve thinking. It is supposed, according to the German booklet, to refreshen you mentally. In two weeks, you are supposed to lose all nervousness, if you only wear the Konzentrator; it helps your health, and, according to the booklet, you must learn how to "think plasticly"—whatever that means. Not only that, but it is supposed to make you a clairvoyant, too! The Konzentrator is advertised to be an *accumulator and collector of mental energy*.



Type of illustration used in the Konzentrator advertising.

Lack of space forbids us to quote all of the rest of the bunk that the Konzentrator is supposed to effect, yet, this fake is not as bad as some of the other American ones, because, at least, it is not supposed to cure all sorts of diseases, and in this way is only a harmless swindle; if it does you no good, it can do you no harm. It is a sort of glorified rabbit's-foot, with the difference that you are paying $10.00 for it. It is, in all respects, just as efficacious as the rabbit's-foot or an elk's tooth, carried as good luck talismen.

Oh, yes, come to think of it. It did stimulate our thoughts to one extent, at least. We wondered what we paid the $10.00 for.

The device is clever, because it is a jumbled, nonsensical conglomeration of metal, leather, cork and gelatine. It has a mystic appearance. Yet the makers are careful not to state the supposed action of the concentrator. They are very silent about it, because they know, of course, that there is no action at all taking place within the Konzentrator.

A harmless swindle, but a fake, nevertheless; all the way through.

Starts Your Car INSTANTLY

You can now start any cold motor without trouble and do it in a few seconds, through the use of a marvelous new device which puts power into the cylinders. Not a gas, not a special liquid. Works from the Dash. Just a touch gets results.

This Amazing Invention

Is simple, but utilizes a well known scientific principle which gives marvelous results in cold weather starting. It fits any car. It fits any engine and can be installed in just a few minutes. The cost is so small that anybody can afford it.

Winter Driving

It's now a pleasure to drive in cold weather. Let your car stand wherever you want to. Don't worry about its getting cold. Step on the starter and away you go. Or a turn of the crank gets equally good results. Use your car in cold weather. It's fun driving when equipped with this marvelous device.

Agents' Offer

Any go-getter who wants to make a lot of money, who wants to be independent of a mere job and who can sell a "good thing" should write quick for our special offer to live agents. Send for information now about big discounts and special proposition, before the best territory is all taken up.

Satisfaction Absolutely GUARANTEED

Yes, we guarantee every Impelerator to do exactly what we claim for it. We guarantee it to make cold weather starting easy and we back our guarantee with a great money back offer. Try the Impelerator for one day, five days, ten days if you want to. In the worst kind of weather, and then if you are not more than satisfied, send it back to us and every penny will be returned to you without question or argument. You can't lose and you can have all the summer advantages of driving in the coldest weather. Write today.

Send No Money

Don't send a cent, but write quick for full particulars which tell you how you can get this marvelous device at a special low price. Remember its cost is so little that anybody can afford it. Even on the cheapest car. It is handsome in design and an ornament to the Dash. Do not hesitate, but write right now.

The Impelerator Corporation, Dept. 2638

25 East Jackson Blvd., Chicago, Ill.

Please send me full particulars, free, and without obligation, of your marvelous invention, the Impelerator, and tell me how I can get one for my car.

If you are Interested in the Agents' Offer, Check Here ☐

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City.....State.....

PARKS

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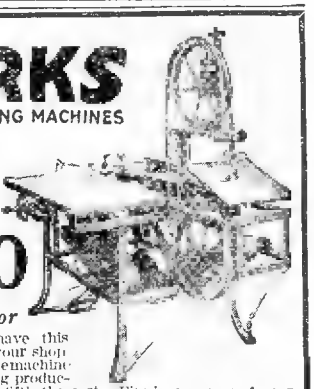
$290

with Motor



You ought to have this handy Parks in your shop. Compact, completemachine designed like a big production outfit at one-fifth the cost. Fits in a corner of your basement. Does any kind of cabinet and joinery work.

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Agents Wanted

Agents: Newest sensation—Rhinestone Initial Fountain Pens. Everybody wants one. No competition. $8.00—$15.00 daily in advance. Chaton Novelty Co., 602 Blue Island, Chicago.

MIRRORS RESILVERED AT HOME. COST LESS 5 cents per square foot; You charge 75 cents. Immense profits. Plating autoparts, reflectors, tableware, stoves. Refinishing metalware, etc. Outfits furnished. Details FREE. Write SPRINKLE, Plater, 955, Marion, Indiana.

Why work for others? Employ agents yourself. Make your own Products. Toilet Articles, Household Specialties, etc. 500% profit. Valuable booklet free. National Scientific Laboratories, 1975W Broad, Richmond, Va.

$50.00 Weekly easy, applying Gold Initials on Automobiles. No experience needed. $1.45 profit every $1.50 job. Free Samples. "Raico Monograms," R1043, Washington, Boston, Mass.

Gold Leaf Window Letters & Script Signs. No experience; 50% Profit. Samples free. Consolidated, 69-It-West Van Buren, Chicago.

New Invention—400% profit. Liquid quick mend for Fabrics and Hosiery. Stops runs. Every woman buys. Hundred other fast sellers. J. E. Johnson Co., Dept. 863, 6129 Wentworth Ave., Chicago.

$12 day representing big Harley factory. Established 35 years. Sell friends, neighbors—daily necessities that repeat—groceries, extracts, medicines, etc. Steady, profitable repeat business. $3.00 hour part time. Samples furnished. Harley Company, Desk C-2524, Dayton, Ohio.

Agents Wanted to sell Men's Hats direct from factory. Write for catalog. Model Hat Mfg. Co., Dept. M-11, East Orange, N. J.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Big money easily made without peddling or outfits. Free particulars. E Elite, 38E Elizabeth St., N. Y.

Agents—We start you in business and help you succeed. No capital or experience needed. Spare or full time. You can earn $50-$100 weekly. Write Madison Company, 566 Broadway, New York.

Rummage sales make $500.00 monthly. We start you, furnishing everything. Experience unnecessary. Monarch, Desk 4, 609 Division, Chicago.

Just Out—New Patented Apron. No strings or straps—$20.00 a day every day; over 100% profit; commissions daily. Write for free offer. Sta-Put Co., Dept. 503, St. Louis, Mo.

We Start You—Silvering mirrors; plating tableware, autoparts, headlights, etc.; refinishing metalware, chandeliers, bedsteads, etc. Immense profits. Outfits furnished. WESCO, B-1246, D, Wichita, Kans.

We Start You in Business, furnishing everything; men and women, $35.00 to $100.00 weekly operating our "New System Specialty Candy Factories." Few dollars start you home or small room anywhere. Booklet free. W. HILLYER RAGSDALE, Drawer 129, East Orange, N. J.

Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Philadelphia, Pa., Dept. 601.

$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 71, East Orange, N. J.

Succeed With Your Own Products. Make them yourself. Formulas, Processes, Trade-Secrets. All lines. Catalog, Circulars free. D. Thaxly Co., Washington, D. C.

Agents: Big season on. No competition. $10.00—$15.00 daily. Rhinestone Initial Buckles, etc., sell on sight. No investment. Chaton Co, 606 Blue Island, Chicago.

Airplanes, Aviation

Biggest, Best Catalog Model Airplanes, Parts, Supplies; 5c postpaid. Ideal Company, 169½ Spring Street, New York.

Airplanes—Send for free cuts and Plans of our wonderful two Place, Companion type, small, high life wing monoplane, and information. How to build this ship, and be sure it will fly, also Propeller literature. Crawford Airplane Manfgr., Seal Beach, Calif.

Airplanes, Aviation (Continued)

Model Airplane Engines: ½ h. p. in 3 lbs.; 1 h. p. in 5 lbs. Stationary Engines: ½ h. p. in 10 lbs.; 1 h. p. in 15 lbs. Circulars free. DYNAMIC MFG. CO., First Nat'l Bank Bldg., Chicago.

Boys—12 Inch Cross-Atlantic Model, "Lindy" type Airplane—50c Takes off by own power. Travels over 40 feet. Very fascinating and educational. Thrilling fun! Easy construction set, complete materials; postpaid U. S. 50c. (No stamps.) Satisfaction guaranteed or money refunded. Model Aircraft Co., Box 331, Chillicothe, Ohio.

Send dime for 12-inch mounted propeller and circular on free three-foot model aeroplane. No selling. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

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For Dens: Relics from Europe's battlefields (also medals) illustrated catalogue with sample war photos 25c. International, 885 Flatbush Ave., Brooklyn, N. Y.

Books

Free—My illustrated Circulars on Newthought, Selfculture. Healing, Yogi Philosophy, Occult, Mystic and Scientific Books. Martens Publisher, Inc., Burlington, Iowa.

Business Opportunities

$100 per month in your home, folding and mailing circular, We furnish everything. Particulars and samples 25c. Adams Mailing Service, Box 236, Belwood, Pa.

Sell Komic Kards in spare time. Dime brings samples, information. Robert Fleming, 331 Weeden St., Pawtucket, R. I.

$50.00 for one Photograph! ! ! Earn extra money, spare time with a camera. Experience unnecessary. Address, REDKRAFTS, Dept. 9, Denver, Colorado.

Sell By Mail!—Books, novelties, bargains; large profits! Particulars FREE! E-Elfco, 525 South Dearborn, Chicago.

Print 250 Signs or Pictures an hour without press, type or machinery. Sample and particulars 10c. Straco, 1015½, Springfield, Ohio.

Free Book. Start little Mail Order business, Hadwil, 5A-74 Cortlandt Street, N. Y.

Amateur Cartoonists: Make money in spare time with new cartoon selling plan. Write Smith's Service, Wenatchee, Wash.

24 Money Making Plans, 25c (coin). Soffron, 780 Hazelwood Ave., Pittsburgh, Pa.

Cameras and Photography Supplies

Make money in Photography. Learn quickly at home. Spare or full time. New plan. Nothing like it. Experience unnecessary. American School of Photography, Dept. 5333, 3601 Michigan Avenue, Chicago.

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Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 975 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

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New "Amateur Chemist" magazine. Everything for chemist. Only 10c copy. Thompson-Allen Lab., 410 W. Pine, Shamokin, Pa.

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Used correspondence school courses sold on repurchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought). Lee Mountain, Pisgah, Alabama.

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500 Formulas and Big Catalog 20c. Ideal Book Shop (N), Park Ridge, Ill.

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Work for "Uncle Sam." Life Jobs. Steady work. $95.00-$275.00 month, Men-women, 18-50. Thousands 1928 appointments. Common education sufficient with our coaching. Experience unnecessary. List positions and full particulars—FREE. Write today sure. Franklin Institute, Dept. A16, Rochester, N. Y.

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Men—Experience unnecessary; travel; make secret investigations; reports; salaries; expenses. Write American Foreign Detective Institute, 304, St. Louis, Mo.

Silvering Mirrors, French plate. Easily learned, immense profits. Plans free. Wear Mirror Works, 16 W. Excelsior Springs, Mo.

Distributors—No canvassing; no capital. Honery, Roseta, Pa.

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Plays, Musical Comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogs, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 99, Chicago.

Insects Wanted

Cash paid for butterflies, insects. See Sinclair's Advertisement on page 1053.

Instruction

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 975 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

Mirror Silvering, complete instructions and formula, no outfit necessary. Twenty-five cents. J. Comiskey, 345-8th St., Ann Arbor, Michigan.

Make Your Own Banjo. Educational and instructive little book sells all. Price $1.00. J. Comiskey, 345 8th Street, Ann Arbor, Mich.

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Free with $25 order our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapes. Oaks Magical Co., Dept. 549, Oshkosh, Wis.

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Men, get Forest Ranger job; $125-$200 month and home furnished; hunt, fish, trap. For details, Write Norton, 265 Temple Court, Denver, Colo.

Firemen, Brakemen, Baggagemen (white or colored), sleeping car, train porters (colored), $150-$250 monthly. Experience unnecessary. 897 Railway Bureau, East St. Louis, Ill.

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Manufacturing— Well Equipped Factory wants Metal Articles to Manufacture. We also Develope—Inventions, Make Dies, Manufacturing Equipment. Sheldon Mfg. Co., Box 5055, Gateway Station, Kansas City.

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Screw Starters, Mechanics and Electricians, you need this new tool. Places screws in practically inaccessible places. Once you use this tool you will wonder how you ever got along without it. Send 25 cents for this wonderful tool. Jiffy Novelty Co., 734 Chamber St., Trenton, N. J.

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Violins—Deep, Mellow, Soulful—on easy credit terms. High grade, wonderful instruments of my own make. Development of many years' experience. Write for book. Gustav A. Henning, 512 University Building, Seattle, Washington.

Old Coins

California Gold, quarter size, 27c; half-dollar size, 53c Columbian nickel and catalogue, 10c. Norman Shultz, Box 706, Salt Lake City, Utah.

Old Money Wanted

$2 to $500 Each paid for hundreds of Old or Odd Coins. Keep all old money, it may be very valuable. Send 10c for new illustrated coin value Book 4x6. Guaranteed Prices. Get Posted, we pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

Patent Attorneys

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Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

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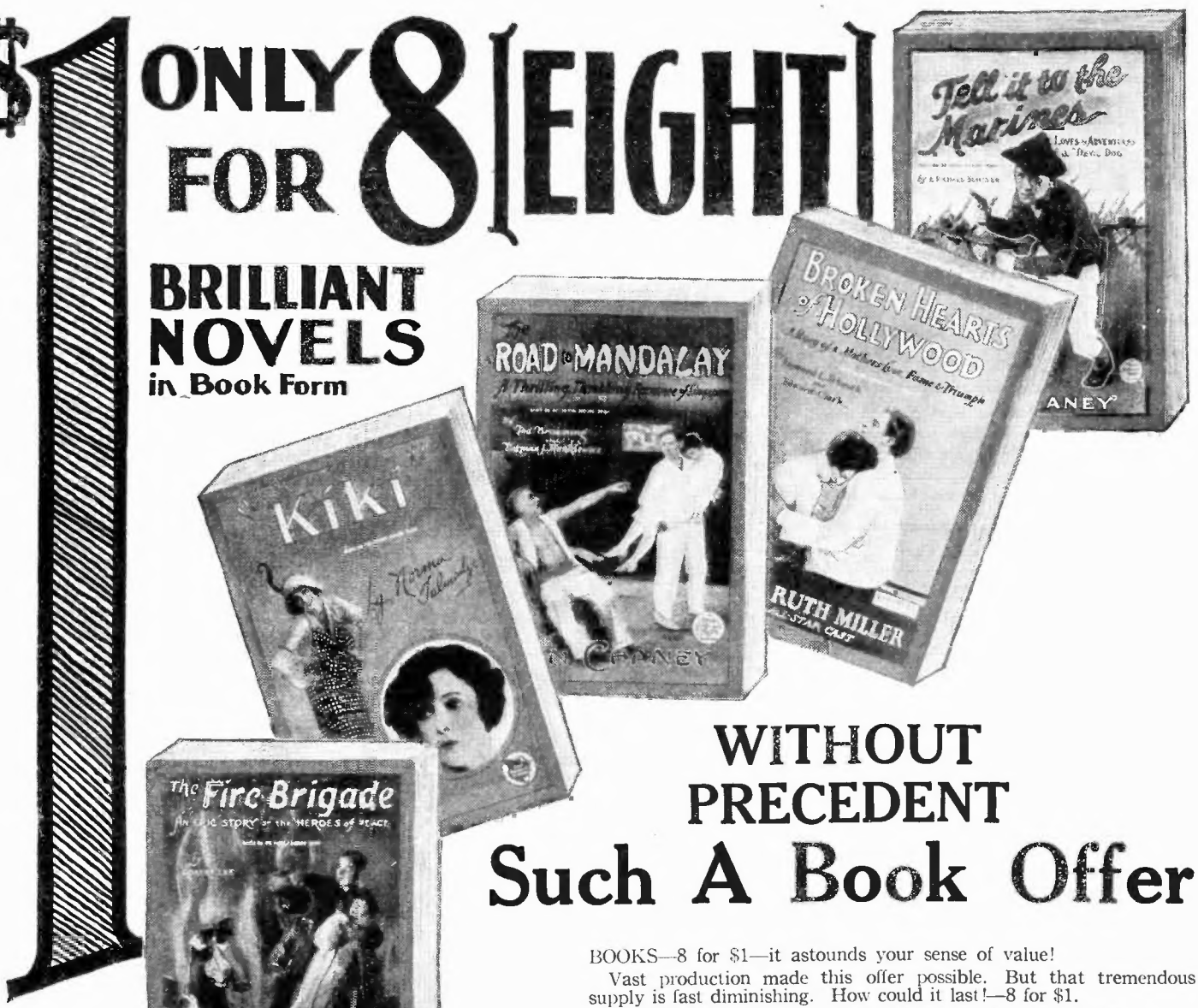

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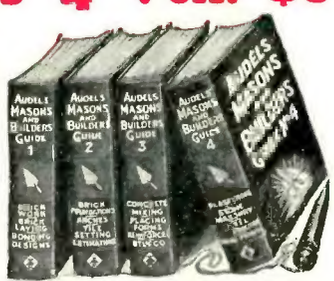

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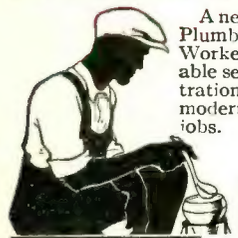

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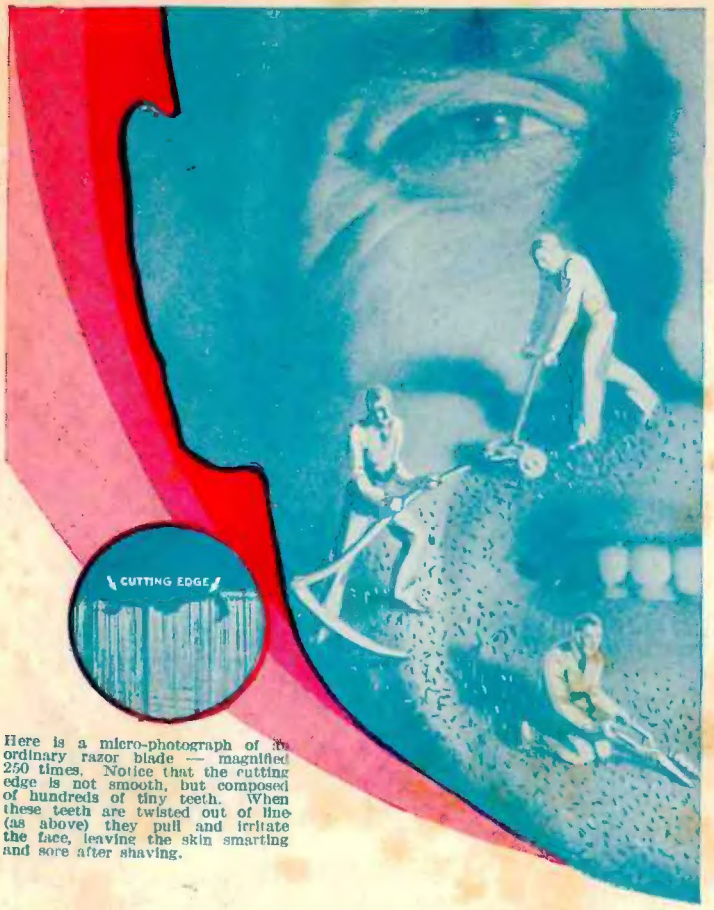

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